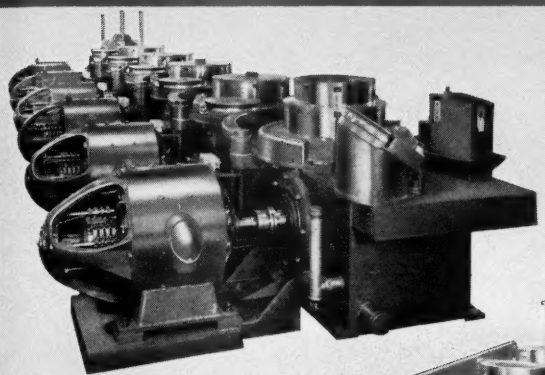
APRIL 1956

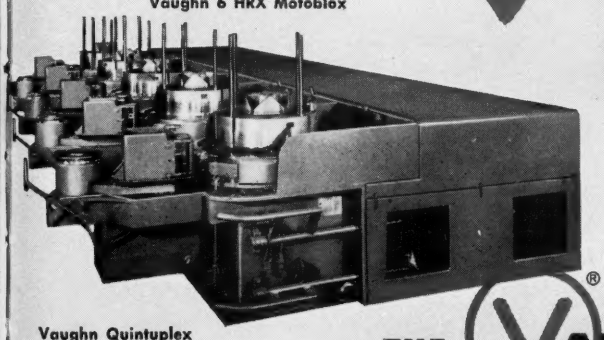
WIRE AND WIRE PRODUCTS



Vaughn 6/7 HRX Motoblox, with motor covers removed

Vaughn 5/6 HRM Motoblox

Vaughn 6 HRX Motoblox



Vaughn Quintuplex 5 HRX Motoblox

KEEPS YOUR *ROUGHEST* SCHEDULES *SMOOTH!*

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The highest present development of continuous, non-slip wire drawing is represented by Vaughn Motoblox. The original Motoblox was a Vaughn-pioneered "first" —and the Vaughn Motoblox of tomorrow will lead in their turn, in every respect of speed, safety, versatility and increased production. • It pays *always* to specify VAUGHN.

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OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

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2. HIGH PRODUCTION — Time to temperature cut in half and with shorter soaks for required physicals.
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7. ENGINEERING ASSISTANCE — The same high standard of engineering service and assistance that Lee Wilson users have known in the past, is assurance of maximum performance.

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It is interesting to note that this group now is being used daily, in numerous mills for the drawing of high carbon, process, rope, spring, etc. wire, and for low carbon nail, galvanized, process, open die, etc. wire for various end uses.

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TELEPHONES: 2131 — 2141 — 2151

These eye-catching products are proof that steel wire can be prettied up. The candelabra and the wire dividers of the record "caddy" are finished in black bonderite, while the remaining items are plated with lustre-bright brass.

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These and other attractive housewares are made by Artistic Wire Products Co., Inc., East Hampton, Conn., from steel wire which we have been supplying for about nine years. A leading manufacturer of kitchen and houseware specialties, Artistic requires a wire having a surface suitable for spot-welding and plating.

Their multiple electro-welding machines call for wire with a minimum of surface irregularities. After welding, they finish the wire with black bonderite or with metal-plating, depending upon the product. Their "Vinylmaid" line of dish drainers and other specialties are coated with vinyl plastic in popular colors to match the modern kitchen.

A big part of our job is working closely with wire users, developing the best type of wire for each different application. Whether you need one of our special-purpose wires or one of the more ordinary types, you can count on our modern wire mills to do the kind of job that will keep your steel wire problems to a minimum.

Perhaps our wire-making experience can be of help to you right now. Just phone the nearest Bethlehem sales office or write to us at Bethlehem, Pa.

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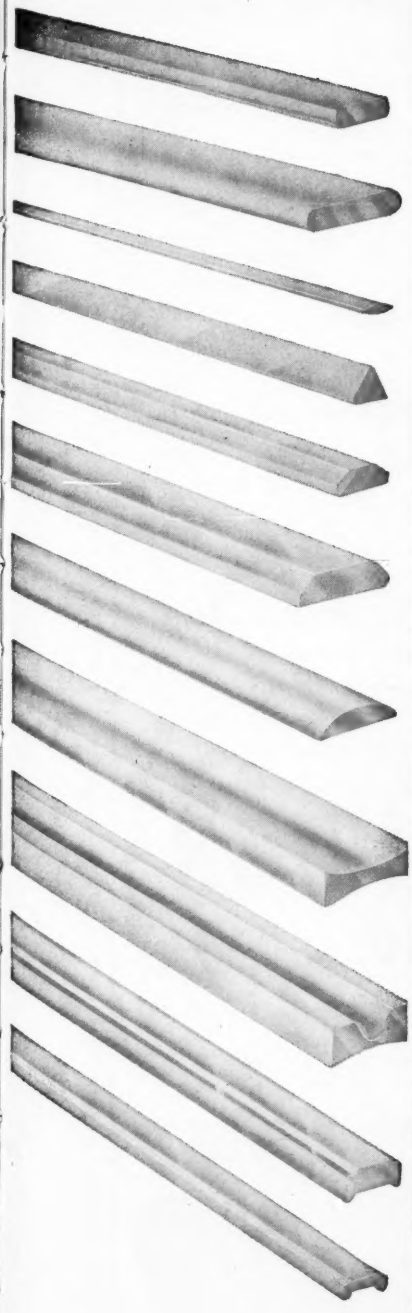

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WIRE

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in Coils or Straight Lengths

COMPLETE METALLURGICAL SERVICE

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SPRING WASHERS	RETAINING RINGS
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Shaped Wire in Coils or Straight Lengths, Ferrous or Non-Ferrous.

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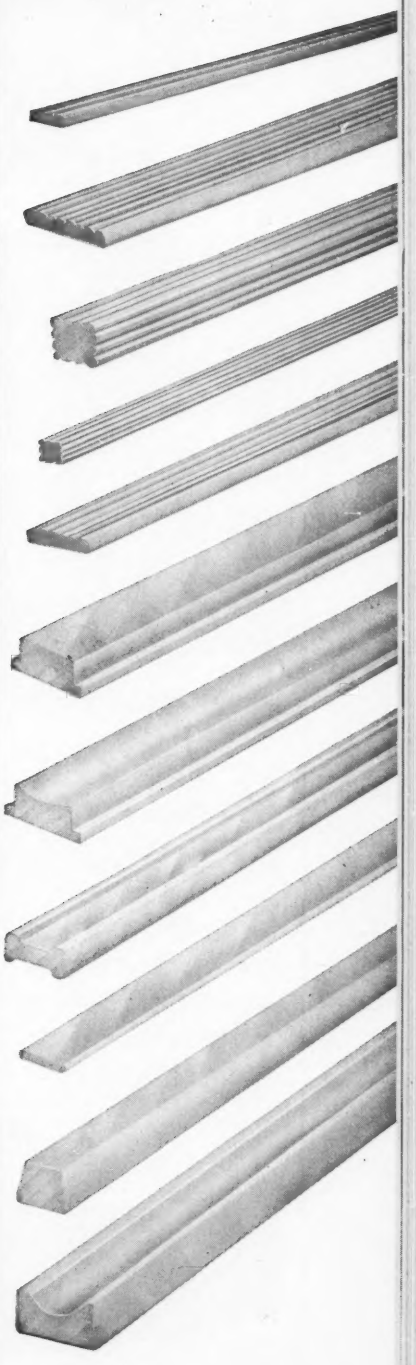

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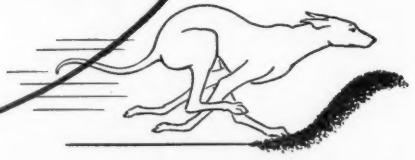

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Exclusive air-cooling method removes heat from wire—insures meeting exacting specifications.

DRAW IT ON

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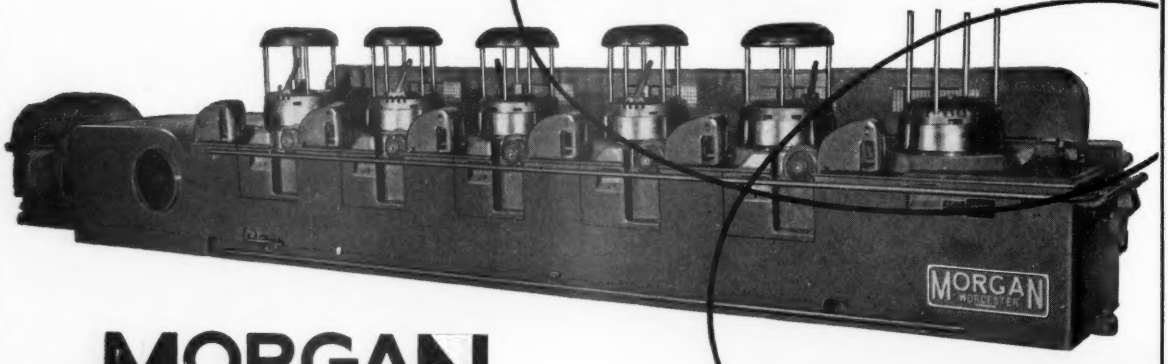

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Reg. U. S. Pat. Off.

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 31 April, 1956 No. 4

Designated as Official Publication By The Wire Association

Contents

The Wire Association Mid-West Regional Meeting 382

Editor's Desk 413

The Wear of Diamond Dies
by L. Schultink, H. L. Spier and A. J. van der Wagt 415

Mechanical Descaling of Wire Rod
by Clemens H. Eisenhuth 421

A User's View of Plastic Insulated Conductors in Outside Telephone Plant
by R. Foulkrod 427

General Properties of The New Super-Polyethylenes
by George H. Sollenberger 433

Modern Straightening and Cutting Equipment
by William DeSenti and Arnold J. Tenner 437

The Ichabod Washburn Story 440

The Wire Association West Coast Regional Meeting 441

Government Wire Production Information 442

Outstanding Personalities of the Wire Industry 449

A Review of Recent Wire Patents 457

Copper Statistics 464

Steel Statistics 465

Index to Advertisers 487

Where-To-Buy 488-492

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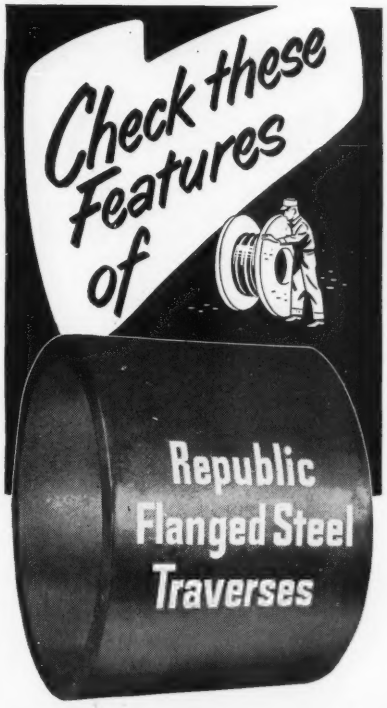

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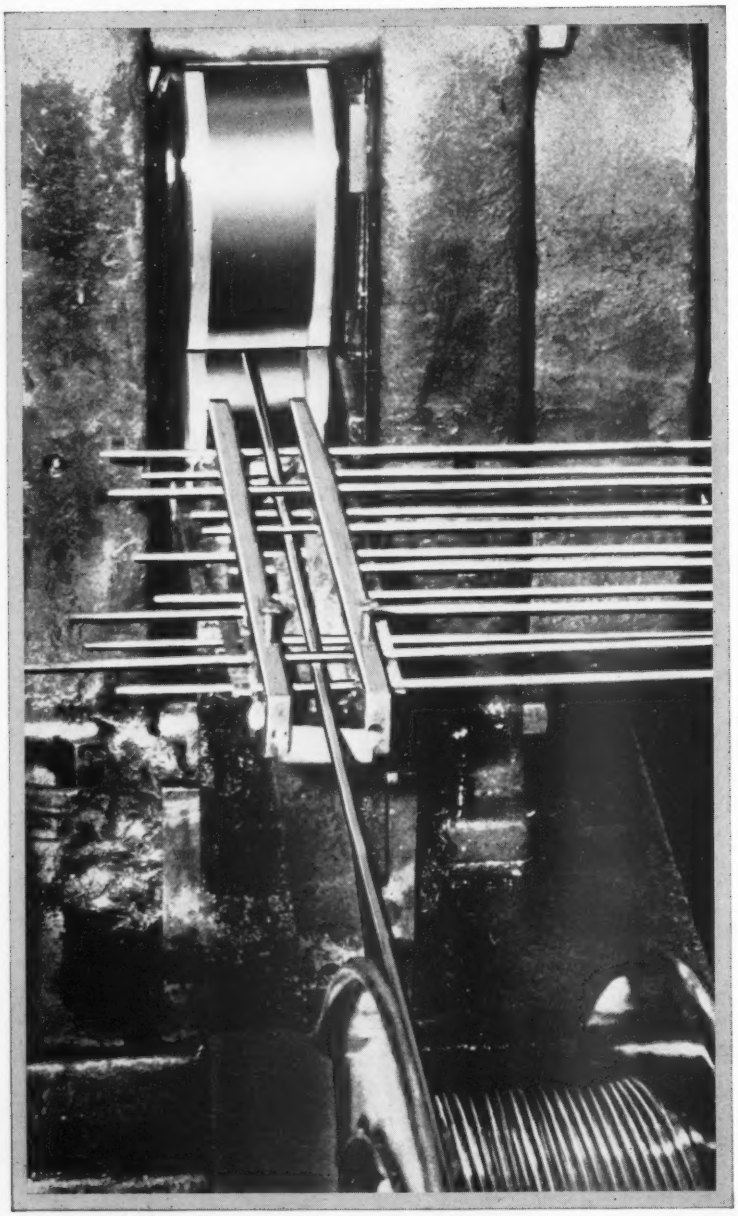

Precision textile loom reed, produced at the Knowles Loom Reed Works, Inc., with Carboloy® cemented carbide rolls, has been noticeably free from the imperfections caused by steel rolls. Steel rolls mushed as they wore, crowning the wire and causing numerous rejections. The uniform tolerance of carbide rolls eliminated this. Further – the lasting high-luster finish of carbide rolls was imparted to the reeds. Such reeds were and are far more marketable than those produced with steel rolls.

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This Knowles case history of improved product quality, reduced manpower and maintenance costs, and longer roll life is typical of the benefits Carboloy cemented carbides are bringing to the wire industry.

Whether your business is flattening, drawing, extruding, or heading, there's a Carboloy product to fit your needs. For more information, or in-plant assistance from a Carboloy Wire Die Engineer, write today.

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It will be the best wire you can get anywhere. You'll find it remarkably clean and bright—uniform in texture, color and grain—precision tempered for consistent workability.

Chase copper alloy wire uncoils smoothly without twisting or tangling. No time wasted unsnarling *this* wire.

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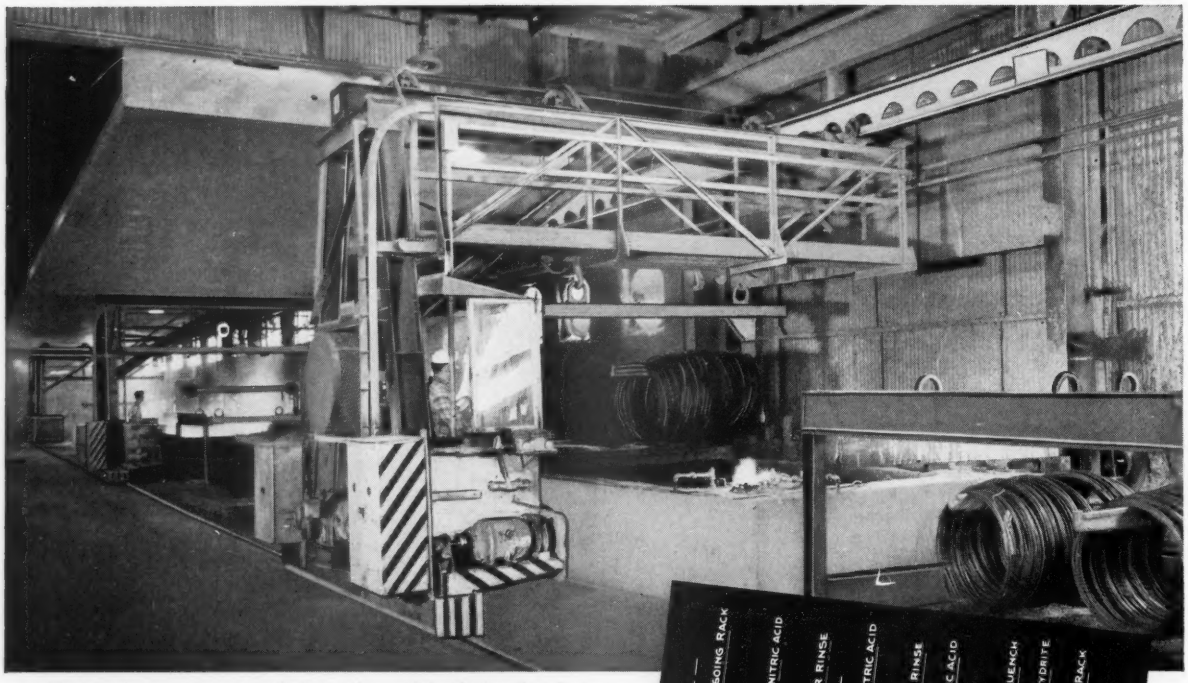
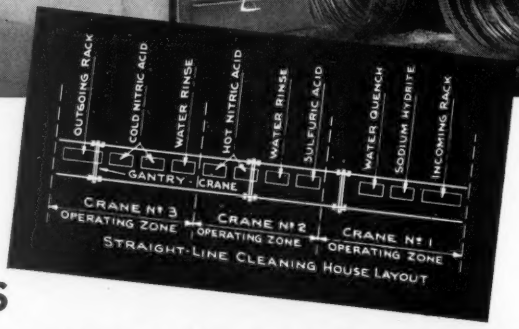
WIRE PRODUCTION SPEEDED

WITH STRAIGHT-LINE CLEANING PROCESS



Three gantry cranes operate at high speed around the clock in this cleaning house. Note how clean and orderly this room is. These are contributing factors to the high production rate secured.



THREE GANTRY CRANES ON SAME LINE PROVE HIGHLY ADVANTAGEOUS

Thousands of tons of wire are cleaned monthly by three especially designed Cleveland Tramrail gantry cranes working 24 hours a day, seven days a week, in the cleaning house of an important stainless steel producer.

Each crane is assigned to a section of the straight-line layout. The first crane picks up loaded hooks of wire from a rack and dunks them in a sodium hydrite tank and a water quench. Then the second crane takes over, advancing the wire through a sulfuric acid tank, water rinse and hot nitric acid bath. The third crane carries them through a water rinse and cold nitric acid tank and places them on the outgoing rack.

The efficiency which a straight-line layout with gantry cranes introduces in a cleaning house is usually an eye-catching figure. Man-hours required for cleaning a given amount are generally reduced from one-third to one-half over that for old-fashioned cleaning methods. In addition, a 50% saving in floor space is made. Another important feature is the cleanliness that it makes possible. To operate in a clean, orderly room not only aids production, but is more healthful for employees and boosts their morale.

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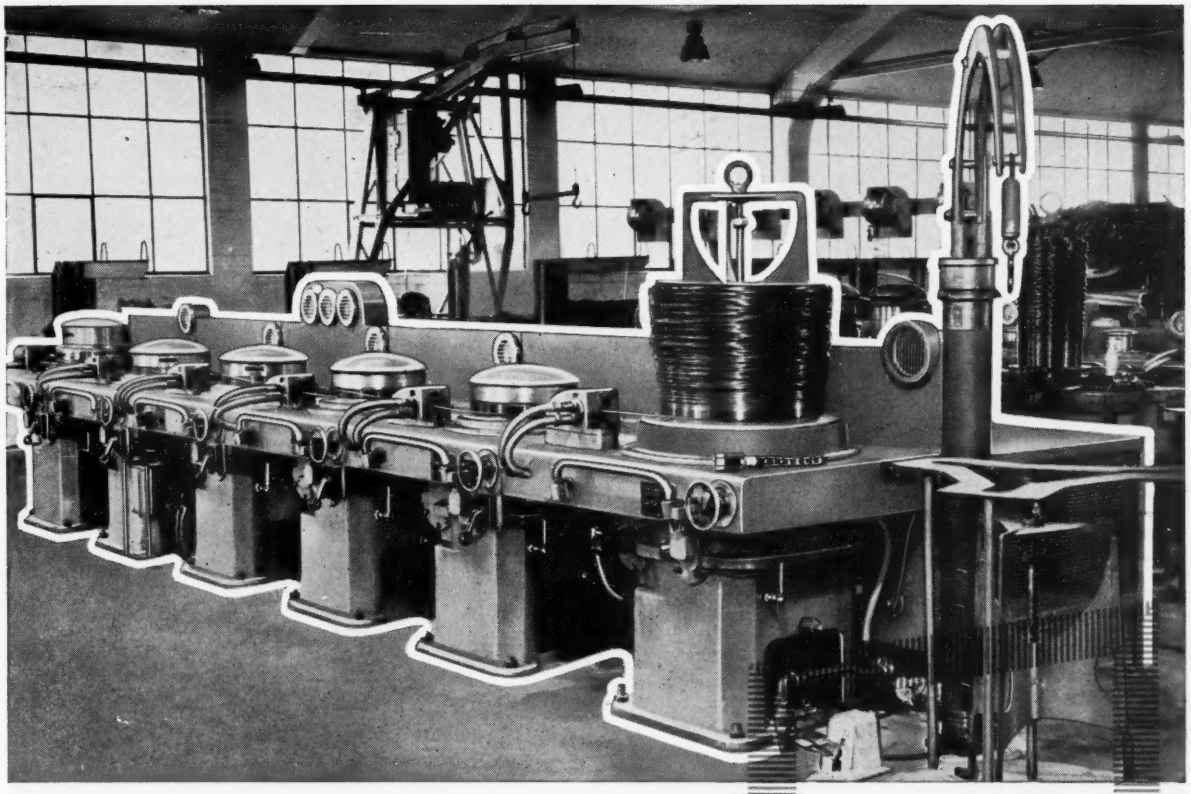

This picture shows a Beeline DG 4, built for an inlet wire diameter of about 7 mm (approx. 2 SWG). High carbon steel.

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Straight-line type Wire Drawing Machine for high production of all wire grades

Prominent Beeline features:

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The machine is at present manufactured in three different sizes:

BEELINE DG 5
for heavy wire, about 13 mm. (7/0 SWG)

BEELINE DG 4
for wire rods, about 7 mm. (2 SWG)

BEELINE DG 3
for wire with an inlet diameter of about 3 mm. (11 SWG)

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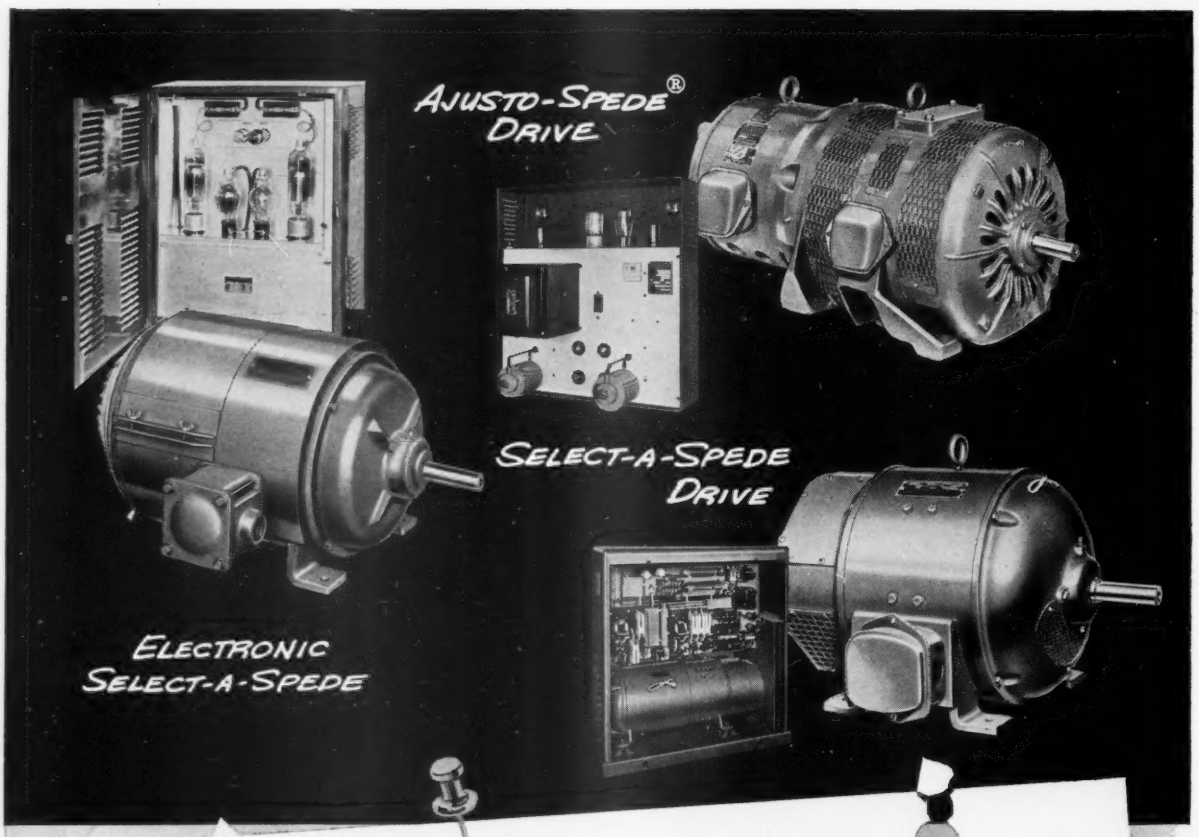

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. . . then it will pay you to look to Louis Allis for the best solution

There are several reasons why it pays to come to us with your adjustable-speed drive problems.

First of all, we have no axe to grind. We can recommend the proper drive for your needs because we make them all. There's no compromising.

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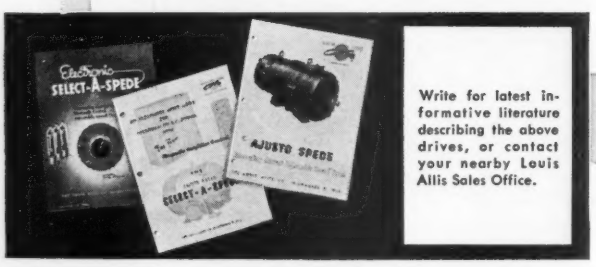

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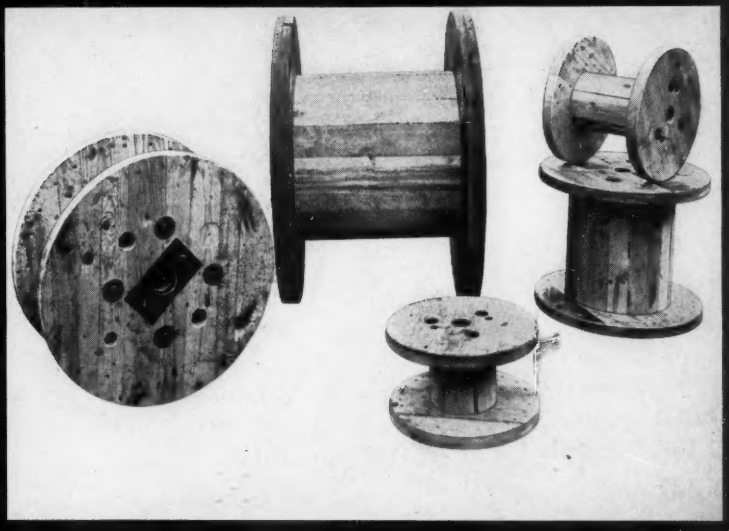

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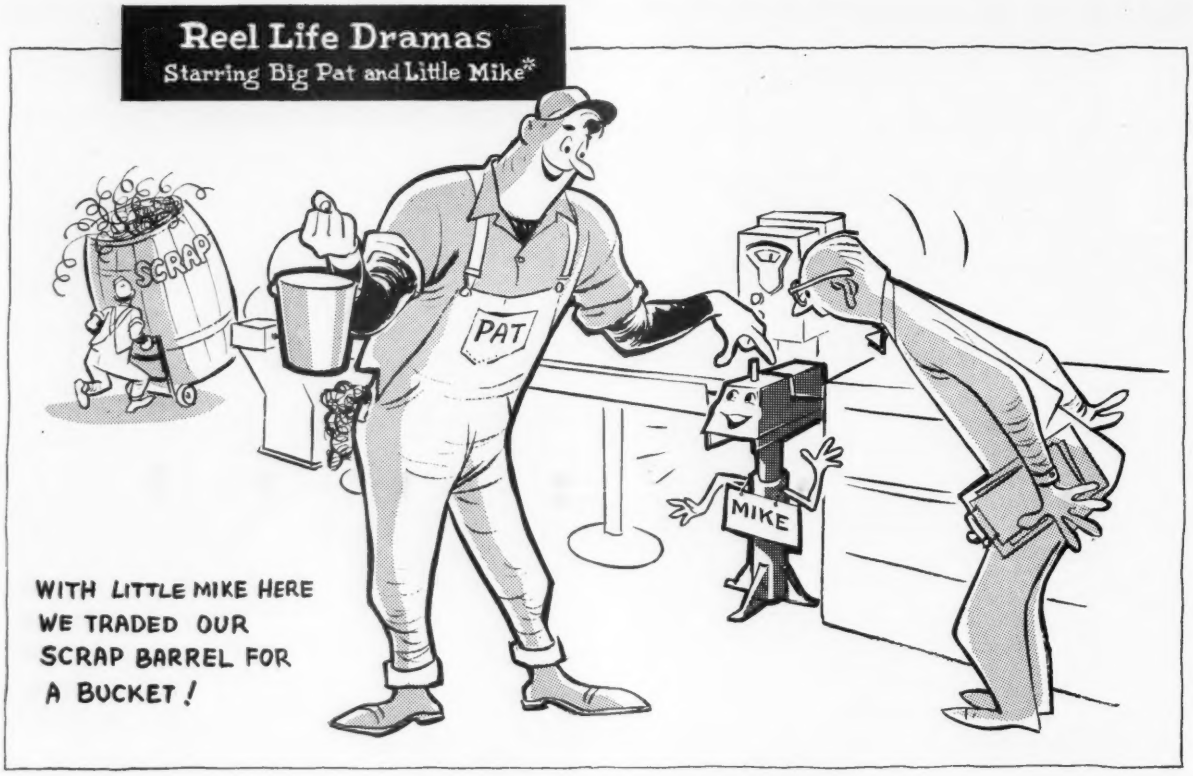
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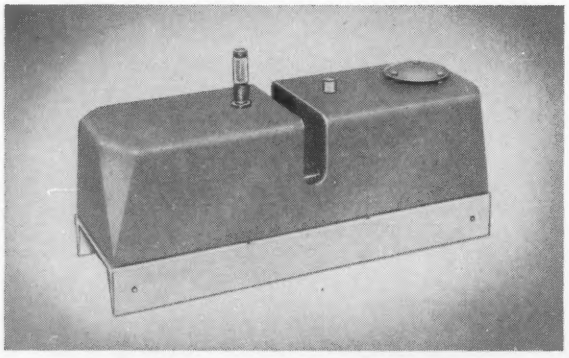

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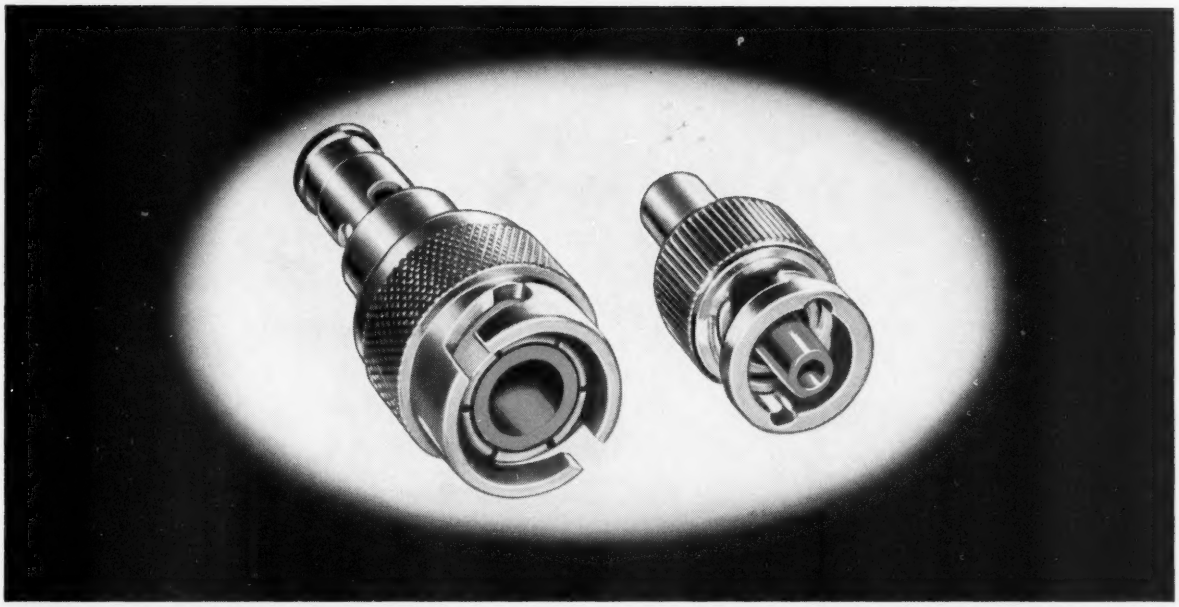

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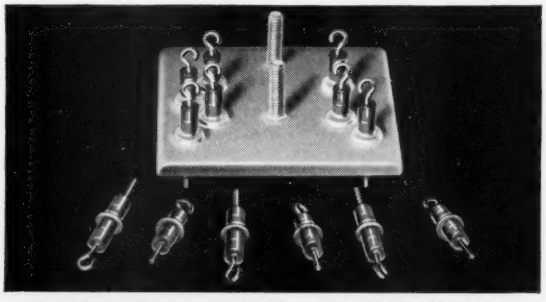
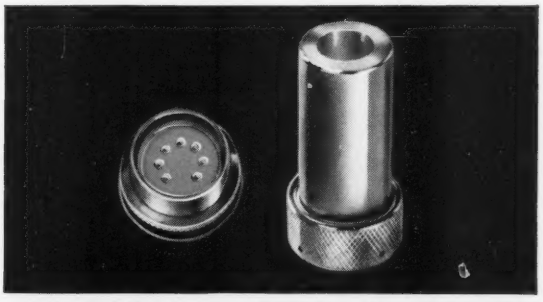


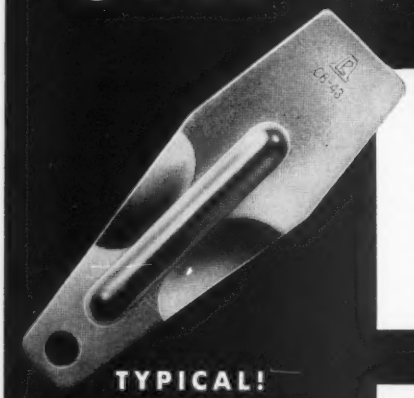
HERMETICALLY-SEALED TERMINALS with KEL-F plastic insulation handle high voltage without flash-over or tracking. Won't shrink, swell, age or lose hermetic seal at high and low operating temperatures. Can be used in contact with highly corrosive chemicals.



TUBE SOCKETS of tough KEL-F plastic. Hermetic seal defies thermal cycling, aging and humidity. Withstands high shock loads without chipping or cracking insulation. Plastic's high dielectric strength prevents shorting or arc-over at high altitudes.

SALT BATH HEAT TREATING

Cuts Production Costs!



TYPICAL!

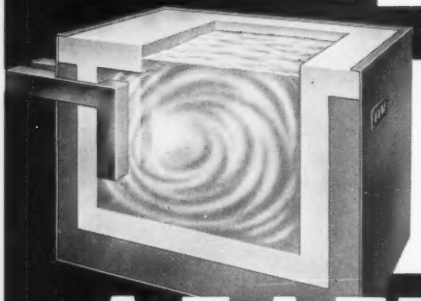
Rejects due to distortion were cut 85% by hardening this clutch lever in Ajax salt baths. Uniform hardness was easily obtained.

1 Parts don't warp out of shape

Distortion of parts is *always* materially less in salt baths than in any other heat treating method because of "automatic preheat," uniform conduction heating of all surfaces regardless of size, ease of fixturing, and the natural buoyancy of molten salt. Most grinding can be completed *before* parts are hardened.

2 Parts get complete surface protection

No atmosphere problems exist since all air is "sealed out" by the molten salt. Even when transferred from one bath to another, a film of molten salt clings to parts, protects them fully to the instant of quenching. Scale and decarb are avoided.



3 Parts heated uniformly throughout

Internal heating by closely-spaced electrodes creates an automatic, electrodynamic stirring action that keeps heat uniform in *all parts of the bath*. Heat treating results are remarkably consistent.

AJAX

HULTGREN

electric SALT BATH furnaces

Cost-savers for

. . . practically any heat treatment
. . . practically any alloy.

25th YEAR

MAIL COUPON FOR CASE HISTORY BULLETINS

ASSOCIATE COMPANIES:

Ajax Electrothermic Corp., Trenton, N. J. —High-frequency induction furnaces

Ajax Electric Furnace Corp., Phila., Pa. / Ajax Engineering Corp., Trenton, N. J. } Low-frequency induction furnaces

AJAX ELECTRIC COMPANY,
928 Frankford Ave. Philadelphia 23, Pa.

Send actual Case History Data on applications checked:

- ☐ Austempering-Martempering
- ☐ Annealing
- ☐ Brazing
- ☐ Carburizing, Cyaniding
- ☐ Hardening
- ☐ Cleaning, Descaling, etc.

Other ☐ _____

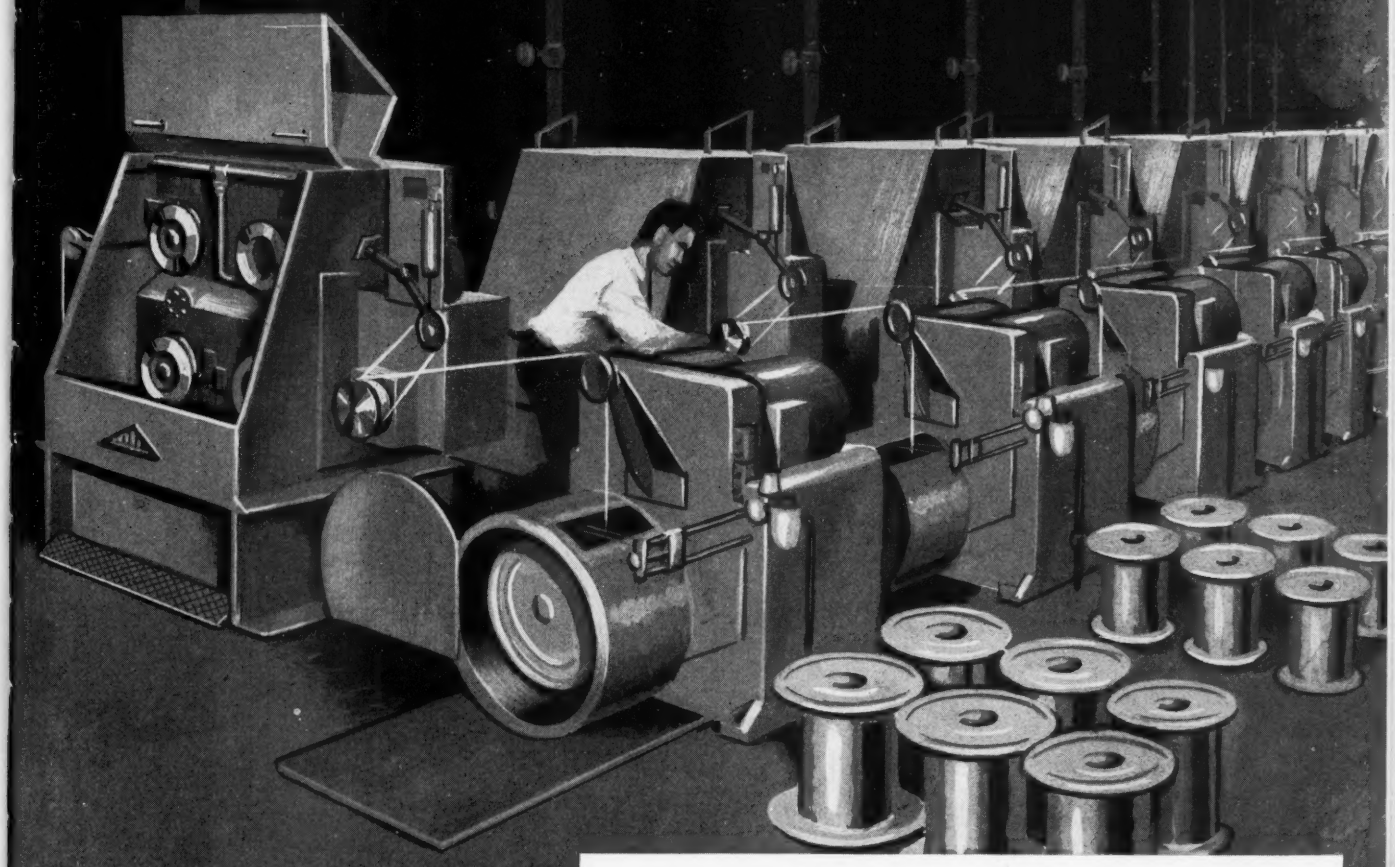
☐ Check here for free HEATING TIME CALCULATOR for salt baths.

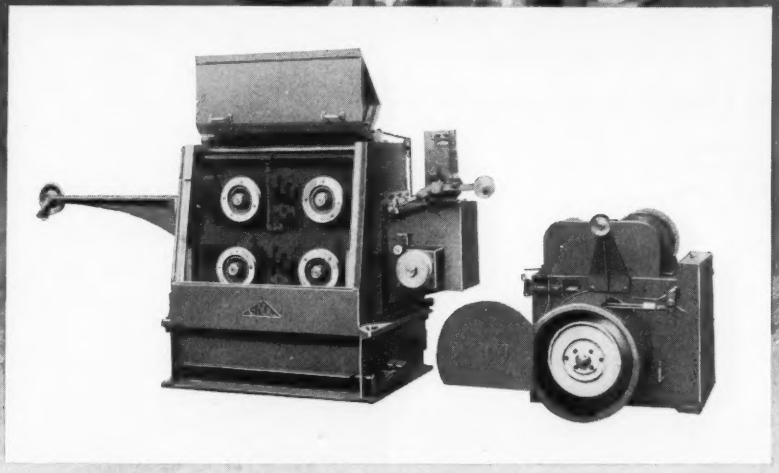
Name _____ Position _____

Firm _____

Address _____

Greater Production . . . Greater Profits
Through Engineering and Manufacturing Skill





Syncro's model C-12 light intermediate wire drawing machine has, as one of its many tasks, the meeting of expanding demands for wire in the telephone communications field. It is another example of manufacturing leadership and superior design inherent in all Syncro products for the wire industry throughout the world. Consult us for any wire and cable mill machinery requirement.

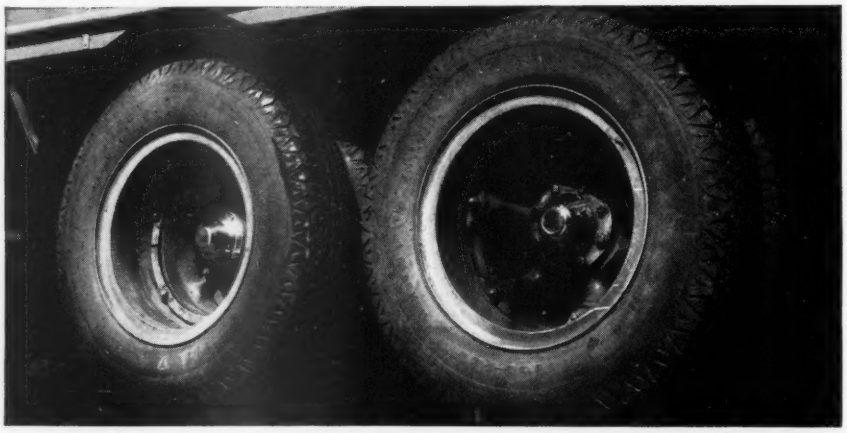
Syncro Machine Company

SYNCRO

Better Machinery for the Wire Industry

PERTH AMBOY, NEW JERSEY, U.S.A. AFFILIATED COMPANY: WINGET SYNCRO LTD. ROCHESTER KENT, ENGLAND

WIRE DRAWING MACHINES • DIE STRINGERS • CONTINUOUS ELECTRIC ANNEALERS • PAYOFFS • CAPSTANS • WIRE INSULATORS • HEAVY DUTY TAKEUPS • TAPERS • SPECIAL MACHINERY



GRIP OF STEEL. The steel reinforcing of the tire bead, upon which pneumatic rubber tires are built and which grip auto wheels securely, is made of high-quality CF&I-Wickwire Pneumatic Tire Bead Wire.

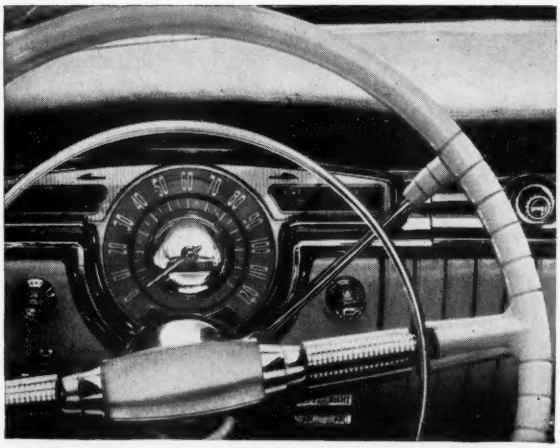
from tires to jar tops . . . wire works wonders

WELL PRESERVED. The wire closure on these glass preserving jars holds the tops tightly, maintaining the air-tight seal. This clamp is made from CF&I-Wickwire Galvanized Clamp Wire.

CF&I-WICKWIRE

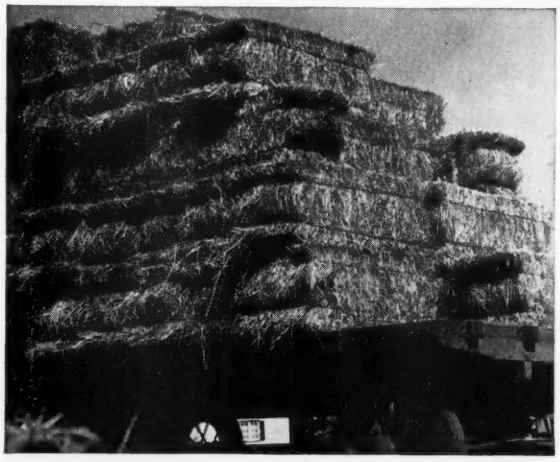
MAKES WIRE FOR

THOUSANDS OF USES



FLEXIBLE POWER. Speedometer cable is made of criss-crossed layers of CF&I-Wickwire Flexible Shaft Wire.

SHADES OF NIGHT. The curtain springs in window shade rollers are made from tempered CF&I-Wickwire Spring Wire.



ALL WRAPPED UP. CF&I-Wickwire Baling Wire is used in baling hay, straw, and other bulky farm products.

TO PLUMB THE DEPTHS. An invaluable part of every plumber's kit is his plumber's snake made of CF&I-Wickwire Snake Fishing Steel Wire.

It's no wonder that wire is all-important in hundreds of different industries...for its properties can be custom-tailored to just about any need. Are you concerned with assembly work, manufacturing, processing? Do you require wire that's fine or coarse, hard or soft, round or shaped? Then the chances are excellent that a CF&I-Wickwire Wire will more than fill the bill.

CF&I-WICKWIRE, with over a century of experience in the manufacture of wire, is always ready to serve you from plants conveniently located from coast to coast. Call or write our nearest district sales office for detailed information.

CF&I-WICKWIRE WIRE

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver
El Paso • Ft. Worth • Houston • Lincoln (Neb.) • Oklahoma City • Phoenix • Pueblo • Salt Lake City • Wichita
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia

3147

All Set for May, the...

MIDWEST REGIONAL MEETING OF THE WIRE ASSOCIATION

TIME AND PLACE: MAY 24th and 25th, 1956, MUEHLEBACH HOTEL, KANSAS CITY, MO.

THE PROGRAM

THURSDAY, MAY 24th

10:00 A.M. — REGISTRATION

1:00 P.M. — TECHNICAL SESSION, at which the following papers will be given:
"Pin Pointing Your Accident Problems" by A. E. Asel, Safety Director, Armco Steel Corp., Sheffield Division.

"The Metallurgical Qualification of High Carbon Steels" by Hugh A. Springer, Metallurgist, Armco Steel Corp., Sheffield Division.

"The Metallurgical Aspect of Scale Control on Hot Rolled Rods" by Earl L. Knapp, Metallurgist, Armco Steel Corp., Sheffield Division.

"Automatic Conveying of Coiled Wire" by C. J. Willis, Asst. Wire Mill Supt., Union Wire Rope Corporation.

6:30 P.M. — Cocktail Party, courtesy of the Sheffield Steel Division, Armco Steel Corp. and the Union Wire Rope Corp.

8:00 P.M. — The Banquet.

FRIDAY, MAY 25th

9 to 10 A.M. — Busses leave the Muehlebach Hotel for a plant tour of the Sheffield Steel Division.

12 to 1 P.M. — Luncheon.

1:00 P.M. — Plant visit to the Union Wire Rope Corp., completed at 4 P.M.

NOTE: For those desiring to visit the Whitaker Cable Corporation's plant, arrangements will be made for a morning or afternoon trip to this electric cable plant in the city.

REGISTRATION FEE: $13.00 for Members; $15.00 for Non-Members.
One fee covers registration, banquet and bus transportation.

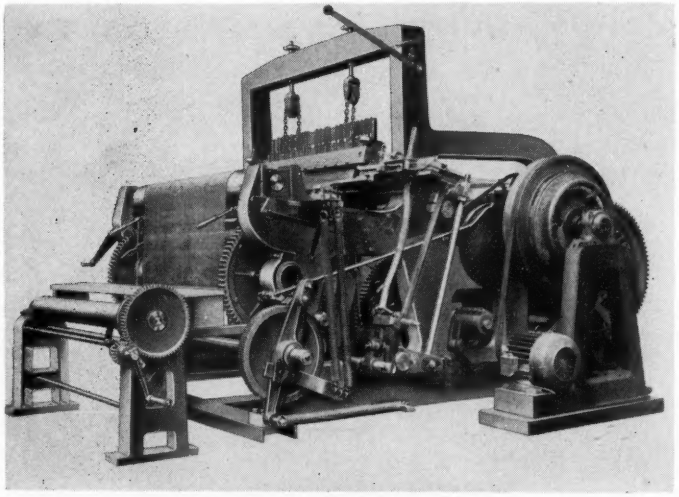
A good time and some interesting features are promised by the Program Committee. Hotel reservations should be made with the Hotel. Please advise Stewart S. Gray, Program Chairman, Union Wire Rope Corp., 21st & Manchester Ave., Kansas City 26, that you will be there.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET • **STAMFORD, CONN.**

ORIGINAL "JAEGER" WIRE WEAVING LOOMS and EQUIPMENT



Furnished for widths from 50 to 80".

MODEL DSa

Weaving Range **of DSa Loom 2" mesh to 25 Mesh per inch.**

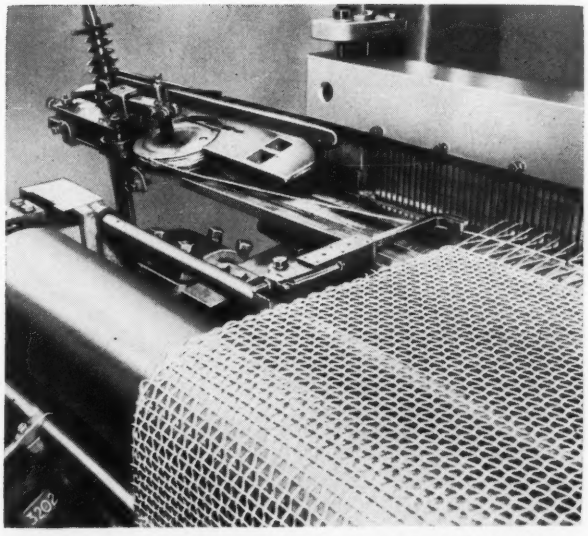
Wire sizes **from .024" to .200".**

Loom can be arranged with Pick-Arms for inserting pre-crimped shoot wires from drum or direct from synchronized crimper.

A Pick Shuttle arrangement can also be furnished for these looms.

Other Equipment we can furnish:

Fourdrinier Looms
Mesh Assembling Looms
Semi-Automatic Looms
Band Looms
Automatic Bobbin Winders
Multiple Bobbin Winders
Beaming Devices
Weaving Reeds
Wire Crimpers for wires up to 5/8" dia.



Shuttle Box of DSa Loom with flanged spool shuttle.

We have a complete line of Looms from the coarsest mesh up to 450 meshes per inch.

For further information write us giving details.

CEDAR WEST TOOL COMPANY, INC.

88-92 WEST STREET • NEW YORK 6, N. Y.

Kaiser Aluminum
KAISER ALUMINUM & CHEMICAL CORPORATION
NEWARK WORKS - HEATH, OHIO
If you're a weaver of insect wire screening...

think of Kaiser Aluminum

STRONG, durable, cladded Kaiser Aluminum fine wire for screening meets or *exceeds* commercial standards and federal specifications—a point worth remembering when you order wire or rod.

Kaiser Aluminum produces 5056 Alclad wire—the strongest of the non-heat-treatable alloys—in .013" and .064" diameters. Redraw rod of this same alloy is available in .375" diameter.

Rigid controls during production assure ductile wire with excellent weaving properties and quality rod that can be drawn at high speeds. Kaiser Aluminum fine wire for screening is cladded for maximum resistance to corrosion.

In addition to wire and rod for insect screening, Kaiser Aluminum also produces these others:

Manufacturers Wire • Rivet Wire and Rod
Welding Wire • Redraw Wire & Rod • Spooled Fine Wire
EC (Electrical Conductor Grade) Wire

All are available in a wide range of alloys, diameters and tempers.

For immediate attention to your needs, contact the Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum and Chemical Sales, Inc., *General Sales Office,* Palmolive Building, Chicago 11, Illinois; *Executive Office,* Kaiser Building, Oakland 12, California.

see our catalog in S PRODUCT DESIGN FILE or write for copy

CONTINUOUS WIRE PATENTING, PICKLING AND COATING LINE

by DREVER

Installed in the plant of
John A. Roebling's Sons Company
Trenton, N. J.

Line Consists of

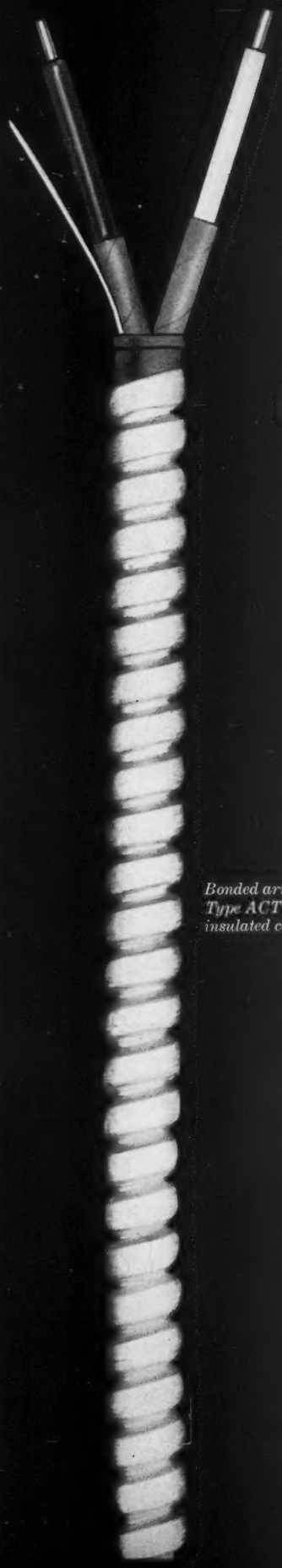
GAS-FIRED, MUFFLE TYPE HEATING FURNACE
GAS-FIRED IMMERSION TUBE HEATED LEAD QUENCHING BATH
COOLING ROLLS
ACID PICKLE TANK
HOT WATER SPRAY RINSE TANK
COATING TANK

CAPACITY, 3000 LBS./HOUR
HIGH CARBON STEEL WIRE
12 STRANDS 0.112" AVERAGE DIA.

Automatic Controls • Can be Electrically Heated
Substantial Savings in Labor Costs!
High Quality Products

Send your inquiries and requirements for equipment to our competent staff of engineers and metallurgists

DREVER COMPANY
RED LION RD. & PHILMONT AVE. • BETHAYRES, PA.



Bonded armored cable, Type ACT, with Opalon-insulated conductors.

Another Monsanto First!

Armored cable with Opalon* vinyl insulation gets U-L recognition!

Opalon improves wiring efficiency—and helps simplify installation!

A new and more efficient armored cable construction has just been perfected. And for the first time cable utilizing vinyl insulation has won recognition from Underwriters' Laboratories.

Builders and electrical contractors will be impressed with the outstanding physical and electrical properties of this cable's conductors which are insulated with Monsanto's Opalon compound.

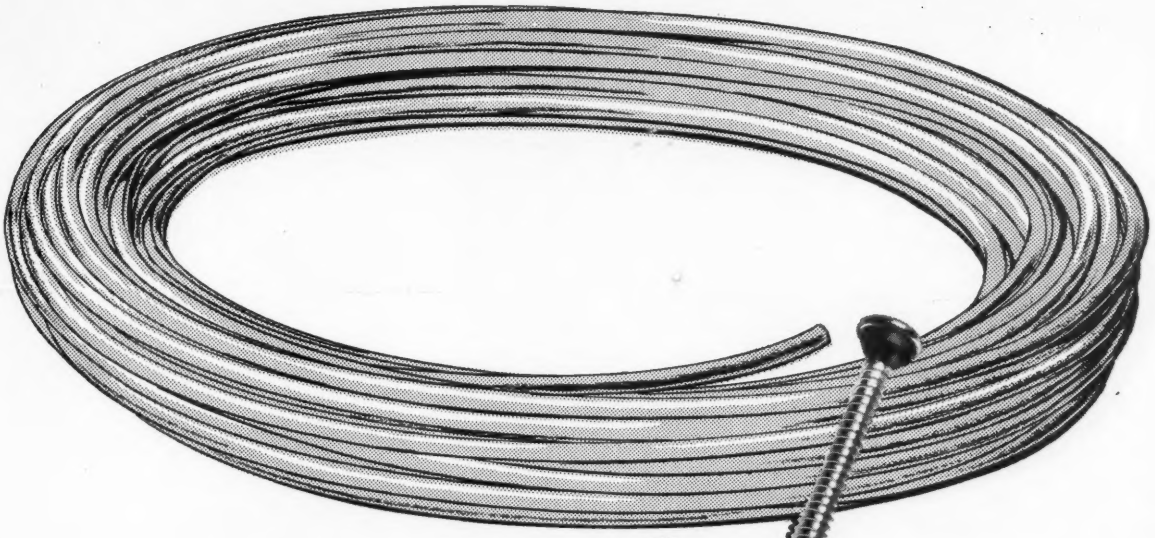
This thermoplastic coating is so tough it reduces the possibility of shorting when wires are pushed over sharp edges in the junction box. Stripping is neater and easier because there is no fraying of the insulation. Color identification is permanent.

This trail-blazing development in wiring was pioneered by three of America's most progressive manufacturers—Columbia Cable & Electric Corp.; Clifton Conduit, Inc.; and Ettco Wire & Cable Corp.—working closely with Monsanto.

For data sheets and complete information on Opalon electrical compounds, write Monsanto Chemical Company, Plastics Division, Room 1119, Springfield 2, Mass.

MONSANTO

*OPALON: REG. U. S. PAT. OFF.



they grip tight...seal tight
—they're made of

CRUCIBLE
stainless steel cold heading wire

These *Tuff-Tite** fasteners, made by Townsend Company, New Brighton, Pa., have a neoprene washer preassembled into the head. They stop leaks... hold tight even where there's severe vibration... seal out moisture effectively.

Of course high speed production of these fasteners, like other types of screws, bolts, rivets and pins, demands cold heading wire with optimum workability. That means wire that's structurally sound and metallurgically uniform... with sufficient ductility to make forming easy... and with good tensile strength.

Crucible stainless steel cold heading wire has all these qualities — *plus* exceptional corrosion-resistance. That's why Crucible Types 305 and 410 stainless are used for the new *Tuff-Tite* fasteners, as well as for many other types of fasteners.

Crucible will fill your stainless cold heading wire needs quickly and efficiently... in the grade and size that best fits your application. Talk over your production requirements with your Crucible representative soon. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

*Trademark

Write now for your free copy of Crucible's new 32-page booklet on Rezistal stainless steel wire.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

finer dies faster for the wire industry with...

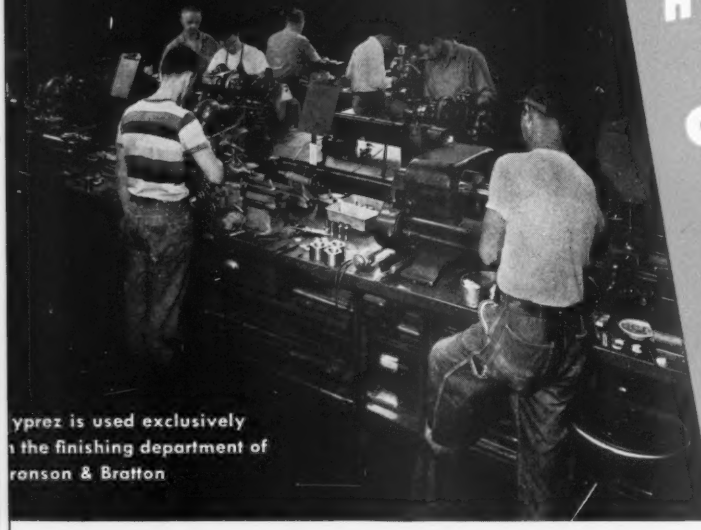
Hyprez used for flawless die finish at modern Chicago plant of Bronson & Bratton, a leading supplier of tungsten-carbide products for the wire industry

HYPREZ

High Precision DIAMOND COMPOUNDS

For economy of muscle, time and cost, Bronson & Bratton, Inc., Chicago, and scores of other die manufacturers and users, demand Hyprez, the original Diamond Compound.

Hyprez is engineered to highest standards of performance: diamond particles of exact grading and concentration; a vehicle assuring permanent suspension; integral color identification; maximum finishing action . . . A complete range of grades, from coarsest to finest.



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n the finishing department of
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Ask for a free demonstration or technical bulletin No. W-46

HYPREZ DIVISION

ENGIS EQUIPMENT COMPANY, CHICAGO 5, ILL.

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SCOVILL WIRE

COPPER-BASE ALLOY

available in . . .

payoffpak

Here is one of the most important and practical "differences" Scovill has made available to wire formers. PAYOFFPAK is the NEW optional (without extra cost) method for packaging Scovill Copper-base alloy Wire, resulting in immediate time and cost-saving advantages to you. Check these advantages listed below . . . then get in touch with us at Waterbury, or at your nearest Scovill sales office listed below.

WIRE IS FED DIRECTLY FROM DRAWING MACHINE INTO PAYOFFPAK.

SHIPPED TO CUSTOMERS FULLY PROTECTED, CLEARLY LABELED . . . EASY TO INVENTORY.

SCOVILL'S WIRE PAY-OFF FEEDER ELIMINATES REELS OR SPOOLS.

LONG CONTINUOUS RUNS from UP TO 500 lbs. of wire in a single strand . . . with assured smooth-running pay-off, from the first foot to the last.

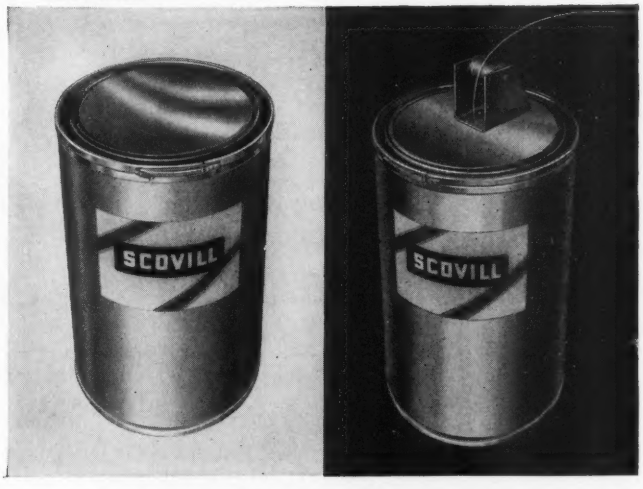
READY-TO-FEED pay-off to wire forming machines **eliminates** reels or spools.

LESS DOWN-TIME between runs . . . no small coils to change constantly.

MUCH EASIER HANDLING and storage . . . PAYOFFPAKS can be stacked.

PROTECTION to wire in shipment and storage.

NO EXTRA COST. Any Scovill Copper-base alloy Wire may be ordered delivered in the PAYOFFPAK in the following sizes and tempers: Diameters .016″ to .060″ inclusive any temper except SOFT. Diameters over .060″ to .212″ inclusive SOFT temper to 2 Nos. HARD.



SCOVILL MANUFACTURING COMPANY, WATERBURY 20, CONNECTICUT

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CLEVELAND 2, OHIO: 6516 DETROIT AVENUE
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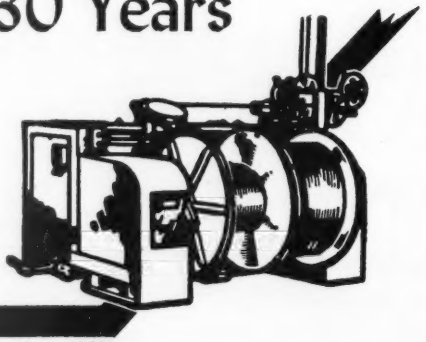
ENTWISTLE MANUFACTURING CORPORATION

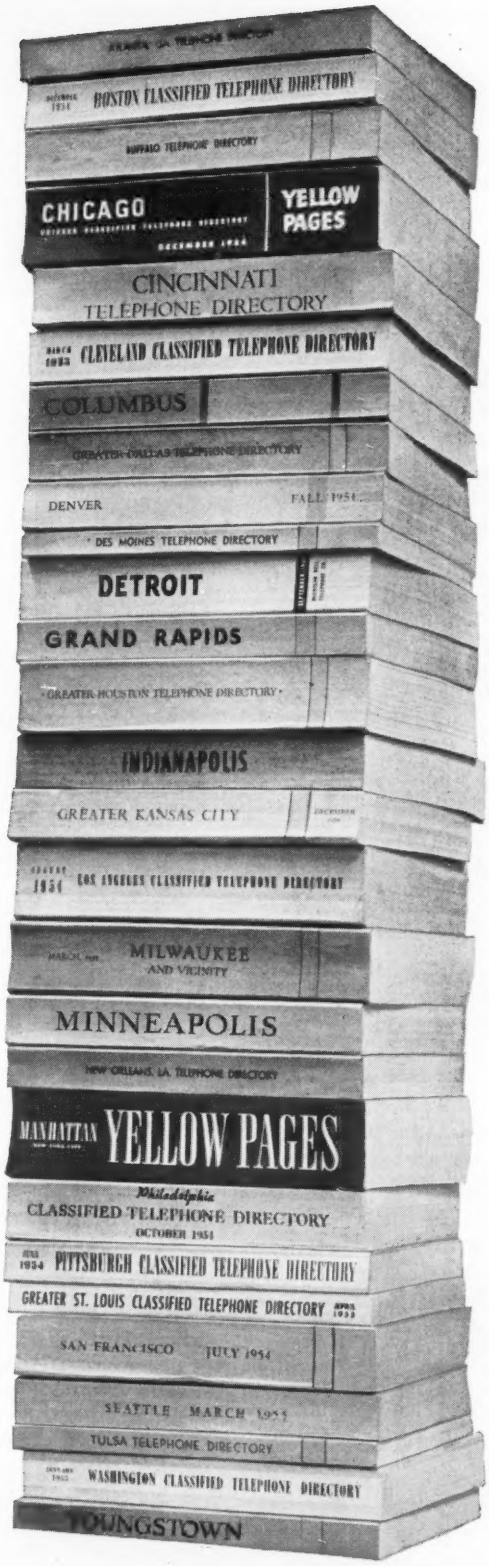
FORMERLY JAMES L. ENTWISTLE CO.

Leading Designer And Builders Of Wire Machinery For Over 30 Years



Plant and Executive Offices
1475 ELMWOOD AVE., CRANSTON (PROV. 7), RHODE ISLAND

Here's where you get the answers to steel problems



●Look under "The Youngstown Sheet and Tube Company" in one of these alphabetical or classified phone books.

They represent the 28 conveniently located district sales offices Youngstown maintains across the country. Offices staffed by men who know the steel business. Men who know and understand **your** steel problems. Men who are qualified to help you get the specific steel you need.

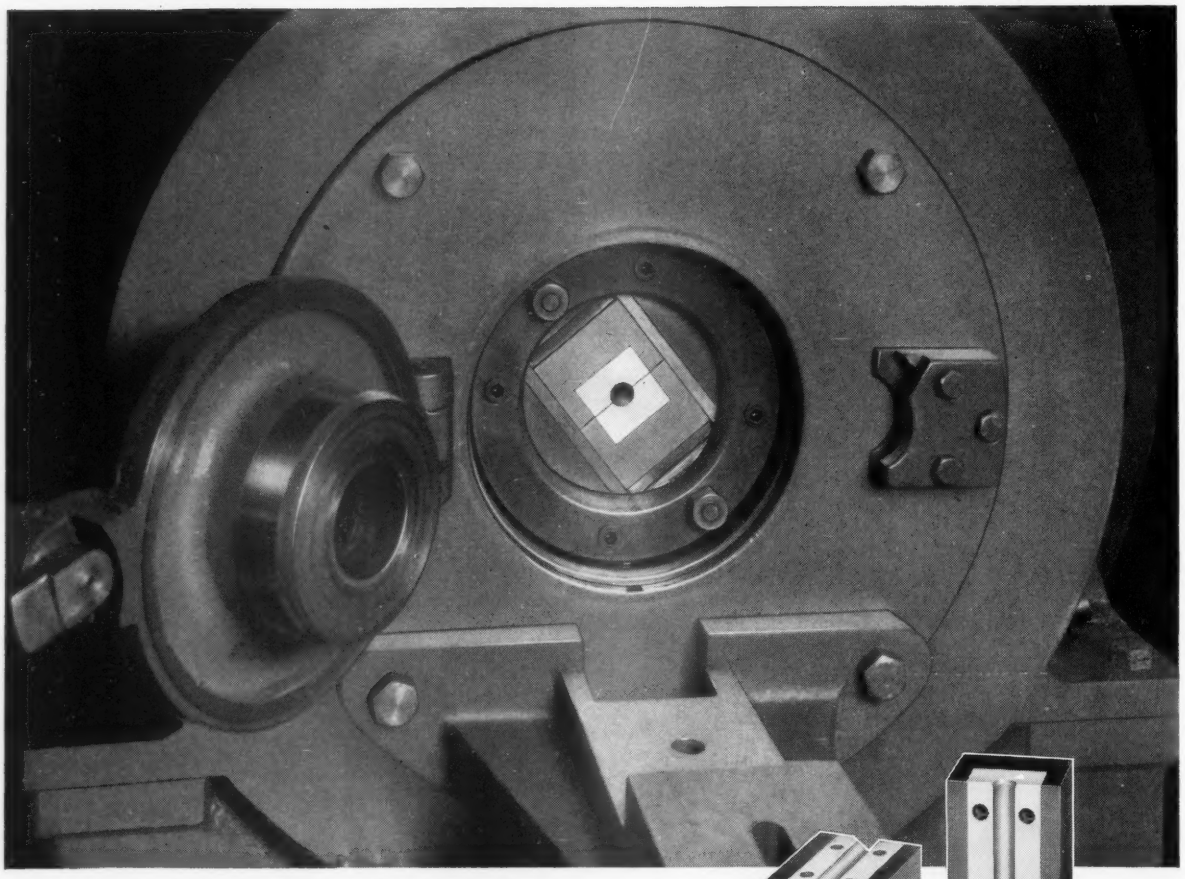
When you want answers to steel problems in a hurry, just call the Youngstown office nearest to you.

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS



You get best results with KENNAMETAL* Die Grades

Kennametal's "90 Series" with six grades and the exclusive non-galling "80 Series" with three grades provide a range to meet the specific requirements of any die application. Hence, die parts of Kennametal sustain high production rates, maintain accuracy over extremely long production runs with a minimum of maintenance, and decrease operating costs.

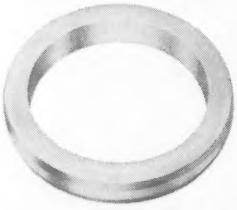
Choose Kennametal for your next die parts . . . for blanking, stamping, compacting, perforating, slitting, piercing, cold heading, swaging, forming, cupping, drawing. Kennametal die engineers will gladly work with you in applying the right grade. Call your nearest Kennametal office or write to KENNAMETAL INC., Latrobe, Pennsylvania. Ask for Booklet B-100.

*Registered Trademark

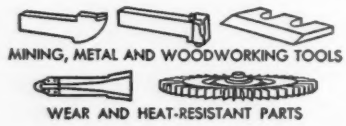
9416

Grade K90 saves $1,575.00 in die costs in 18 months Because of its high resistance to deformation, crushing and edge wear, Kennametal Grade K90, used in the dies shown above for copper tube sizing and straightening, has reduced monthly die cost to only $35.00, as against $122.50 for previous hardened tool steel dies. In 18 months of operation, the saving totals over $1,575.00; and the Kennametal dies are still in operation.

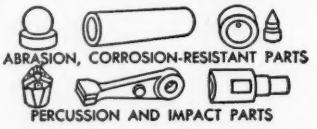
Grade K84 sizes 142,200 tubes against 60,000 . . . with less wear

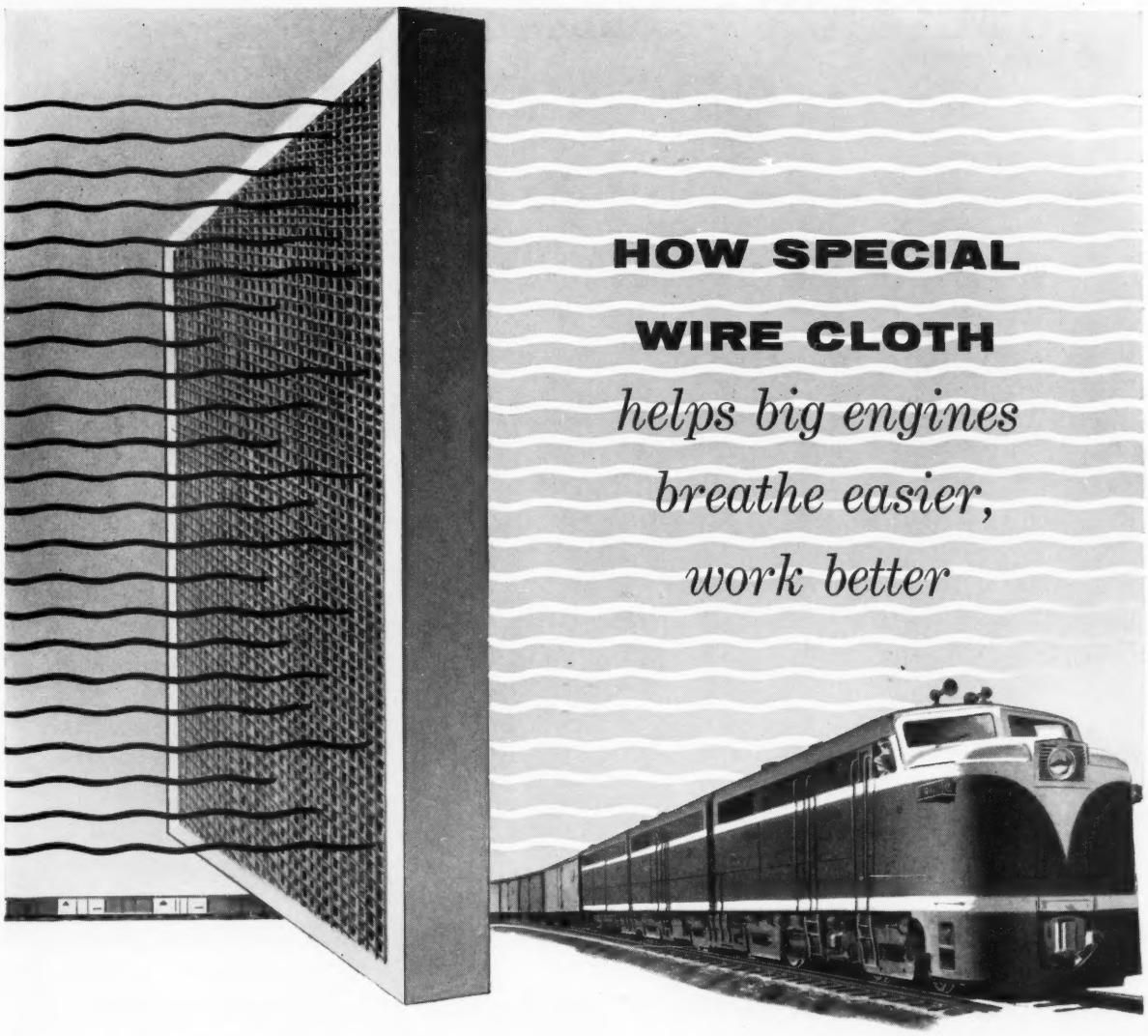


The effectiveness of the tungsten-titanium K80 Series is demonstrated by a set of eight Kennametal Grade K84 tube sizing rings used to size the I. D. of 5″ rocket tubes. With only .010″ reduction in ring diameter, non-galling Grade K84 has sized 142,200 tubes, while in comparison another carbide showed .013″ wear after sizing only 60,000.



INDUSTRY AND KENNAMETAL ...Partners in Progress





HOW SPECIAL WIRE CLOTH *helps big engines breathe easier, work better*

● Keeping harmful grit and dirt out of the lungs of big engines, like locomotive diesels, is no small problem. Determined to do the job better than ever before, a leading filter manufacturer turned to the *Reynolds Wire Division* of National-Standard for a special wire cloth that would trap all the dirt and still let such engines breathe the terrific volume of air they need.

No simple assignment this, for it took months of concentrated development work—not only to develop the *kind* of wire cloth that would do the job, but also to find out *how best* to produce it. It had to be slit into narrow widths, with special lock wires to prevent raveling. It had to withstand a patented method of severe forming and crimping without compacting. And despite the special construction and narrow slitting, it had to be furnished in extra large continuous rolls. All were tough problems to lick!

The *ability* to lick a tough problem in wire cloth is one thing. The *willingness* to do it is quite another. You get *both* at Reynolds Wire. But, problem or no problem, short orders or large volume production, you too will find it pays to turn to Reynolds. Try us and see.

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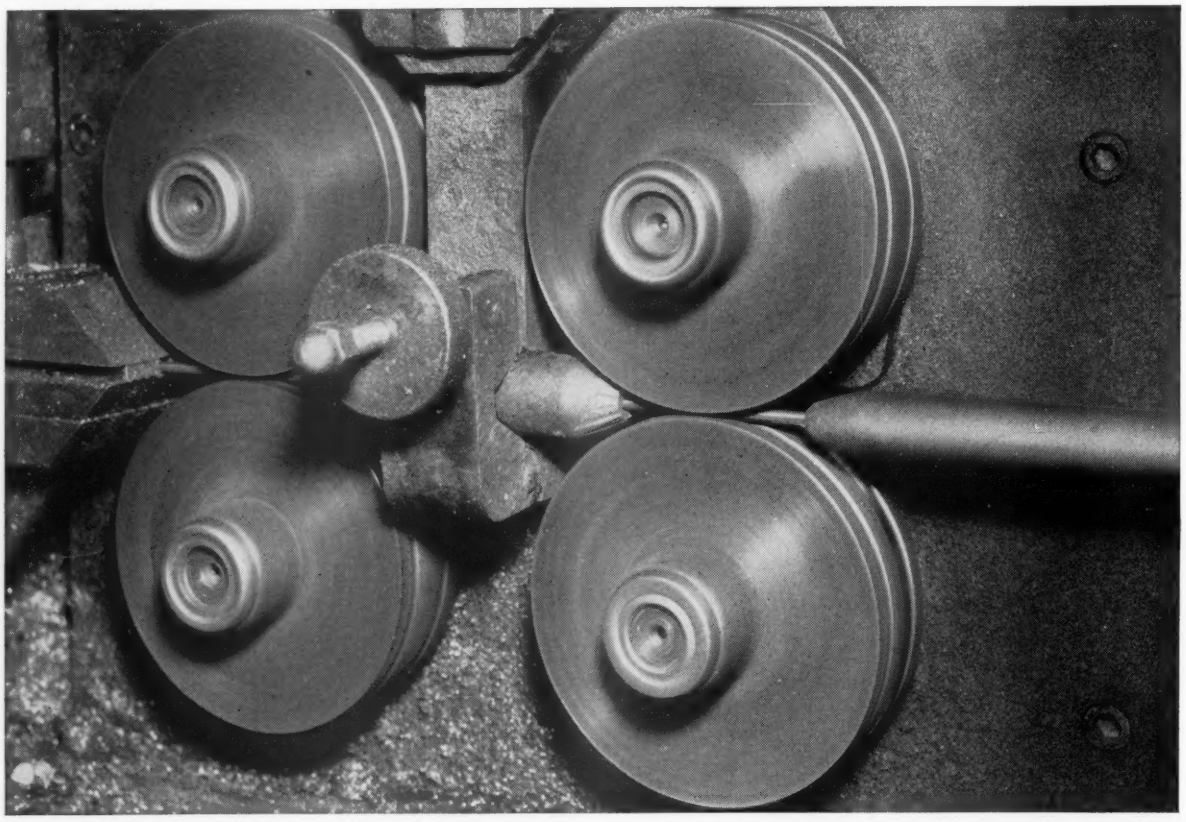
76 MILLION welding rods through these **CROMOVAN** feed rolls!



36 months service and still going strong!

CROMOVAN, a Firth Sterling air hardening, high carbon–high chrome die steel is a terrific performer in wear and abrasion resistance applications.

For example, carbon steel feed rolls at Marquette Manufacturing Company, Minneapolis, lasted only seven months even when serviced constantly, but CROMOVAN replacements are still going strong after 36 months of grueling use and *no* servicing! Four feed rolls guide 14″ welding rods (stainless, carbon, and alloy steel) into a flux coating machine at 700 ft. per minute and 76,000,000 rods passed through them with only .022″ groove wear and *no down time* for redressing.

You, too, can realize comparable savings, reduced maintenance, and higher production when you adopt CROMOVAN for feed rolls, guides and wear parts. Write for Technical Bulletin 20-010 or 20-011 (Free Machining), today.

Mr. Tooley says—

"Firth Sterling offers the advantage of a single source of supply for both tungsten carbides and high grade tool and die steels for every shop tooling purpose. Because we have *both* you get *unbiased* recommendations."

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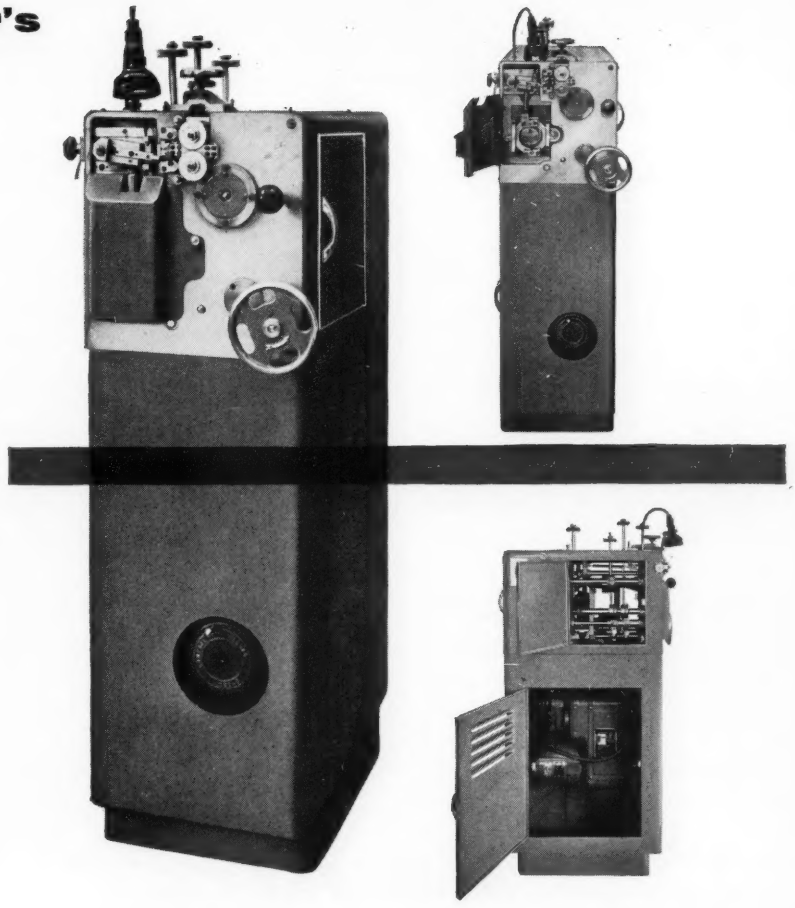
Springmaker's Delight!

.... Torrington's new W-10A

Based on the famous W-10 Spring Machine which has long been standard equipment throughout the industry, Torrington now offers the modernized W-10A Springmaker. This versatile, high-production machine includes many new features, all of which contribute to ease of set-up, correct location of controls, "clean" design and lower maintenance.

Read the specifications. Then call or write for further information on how the W-10A can be put to work in your plant to speed your production and reduce your costs.



SPECIFICATIONS

Wire Diameter Range	.008" to .028"
Wire Length Per Spring	0" to 24"
Coil Range (O.D.)	$\frac{1}{16}$" to $\frac{7}{8}$"
Production	24 to 243 with motorized variable speed transmission 21 to 240 with electronic adjustable speed drive
Drives	½ HP motorized variable speed transmission ¾ HP electronic adjustable speed drive
Extra Wire Feed Gears	0" to 36" of .008 to .024 diameter wire 0" to 48" of .008 to .020 diameter wire
Special Wire Feeds	0" to 6½" (using standard wire feed gears reversed)
Attachments Available	Torsion spring coiling mechanism, double diameter spring control mechanism, continuous coiling, 10 roll—2 plane-quick-opening ball bearing straightener, 5 roll—single plane—quick opening ball bearing straightener
Floor Space	21" front x 28" deep
Wire Line Height	48"
Weight	695 lbs.

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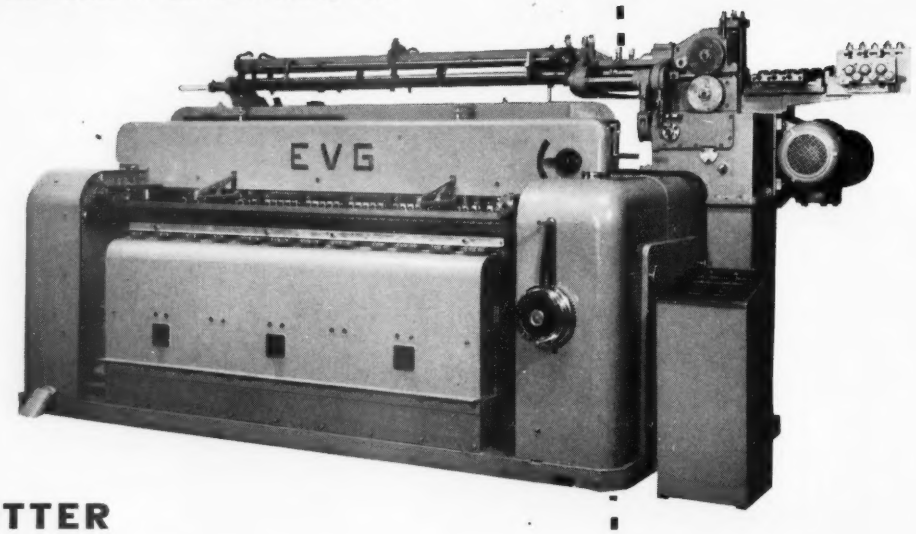
TORRINGTON
MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT

Shown in Picture: The UNIVERSAL (Model G5); available in 96", 128" and 156" widths. Recommended for Road Fabric, Building Mesh.



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Wire sizes from 1/2" dia. down to 22 ga. Wire spacings from 1/2" x 1/2" upward, including all standard constructions. Speeds up to 90-100 cross wires per minute. Get the full facts today.

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You, too, *pay* for the best spring steel... make sure you *get* it. Specify Roebling. John A. Roebling's Sons Corporation, Trenton 2, N. J.

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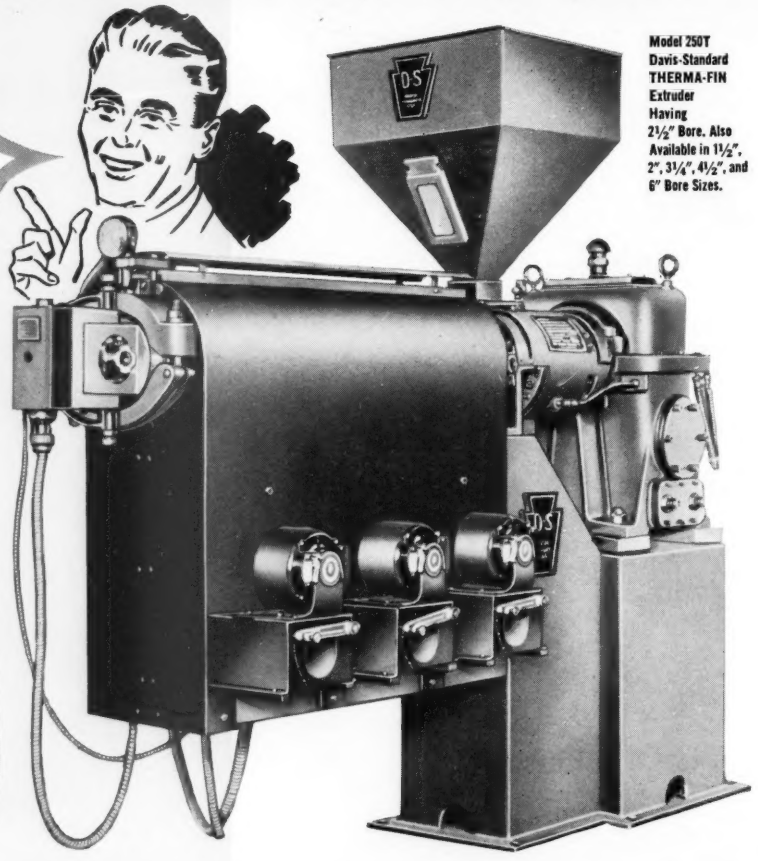
TO QUOTE A CUSTOMER:

"...we have never had a piece of machinery start up so easily and with so little fuss as our new 3¼" Davis-Standard polyethylene extruder. We are highly pleased with the equipment... and are looking forward to the installation of the new, larger machine..."



Model 250T Davis-Standard THERMA-FIN Extruder Having 2½" Bore. Also Available in 1½", 2", 3¼", 4½", and 6" Bore Sizes.

It is indeed a stimulating experience to receive an unsolicited comment such as this from the owner of one of our THERMA-FIN Extruders*. This opinion, along with the many other congratulatory messages we have received, reassures us that Davis-Standard's policy of producing equipment of only the highest *quality* will always pay dividends.

The complete wire machinery line offered by Davis-Standard includes:

THERMA-FIN *Thermoplastic Extruders**

Rubber Extruders	*Steam and Water Seals*
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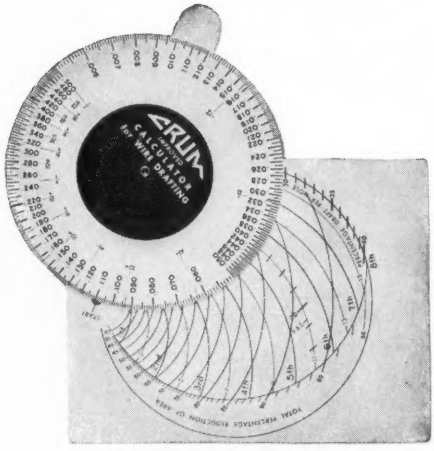
CRUM CALCULATOR

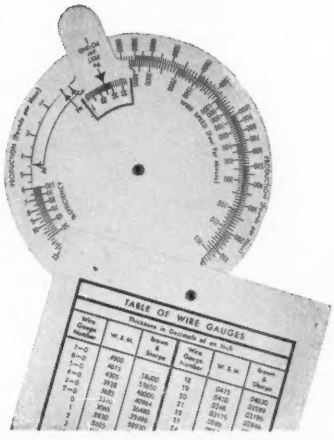
FOR WIRE DRAFTING



Front view of Crum Calculator.

THIS NEW DOUBLE-PURPOSE CALCULATOR WILL:

1. **Provide quicker and more accurate information on die sizes and reduction areas;**
2. **Calculate wire production rates for various speeds and efficiencies.**



Reverse view of Crum Calculator.

SOME OTHER FEATURES OF THE CALCULATOR

- Has new scale for more accurate determination of small percentages.
- Gives readings in B & S gauges.
- Intermediate lines provide reductions for 16 holes in one setting.
- New rectangular shaped back for better protection of calculator.
- More legible % draft-per-hole scale.
- Vinyl plastic construction, resistant to wear, warping, dirt, perspiration, wire drawing soaps—can be cleaned.
- Still fits your vest pocket.
- Handy tables of W & M and B & S gauges.
- Feet per pound calculating scale for steel, copper and aluminum wires.
- Durable, accurate, easy to use.

The improved Crum Calculator is worth its weight in gold in time saving —no laborious mathematical calculations necessary when you use it. Instruction sheet with examples accompany each Calculator. You should have one or more in your wire drawing department.

THE PRICE: $5.00 EACH

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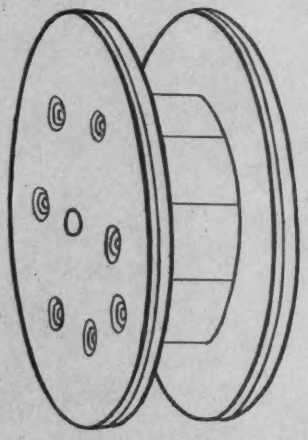

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- LIGHT IN WEIGHT
- SUPERIOR SERVICE
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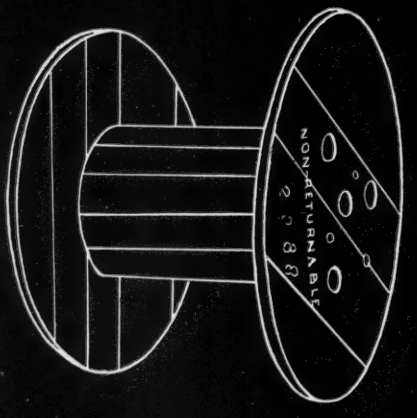

- SAVE COSTLY MAINTENANCE
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Remember These are products of the most modern up-to-date reel plant in the world. Manufactured by a company with nearly 50 years experience and a background of exhaustive testing and research in the laboratory and the field.

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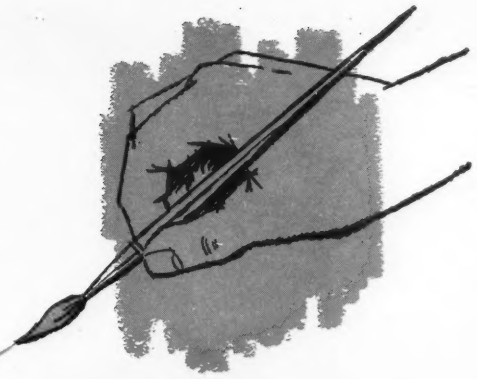
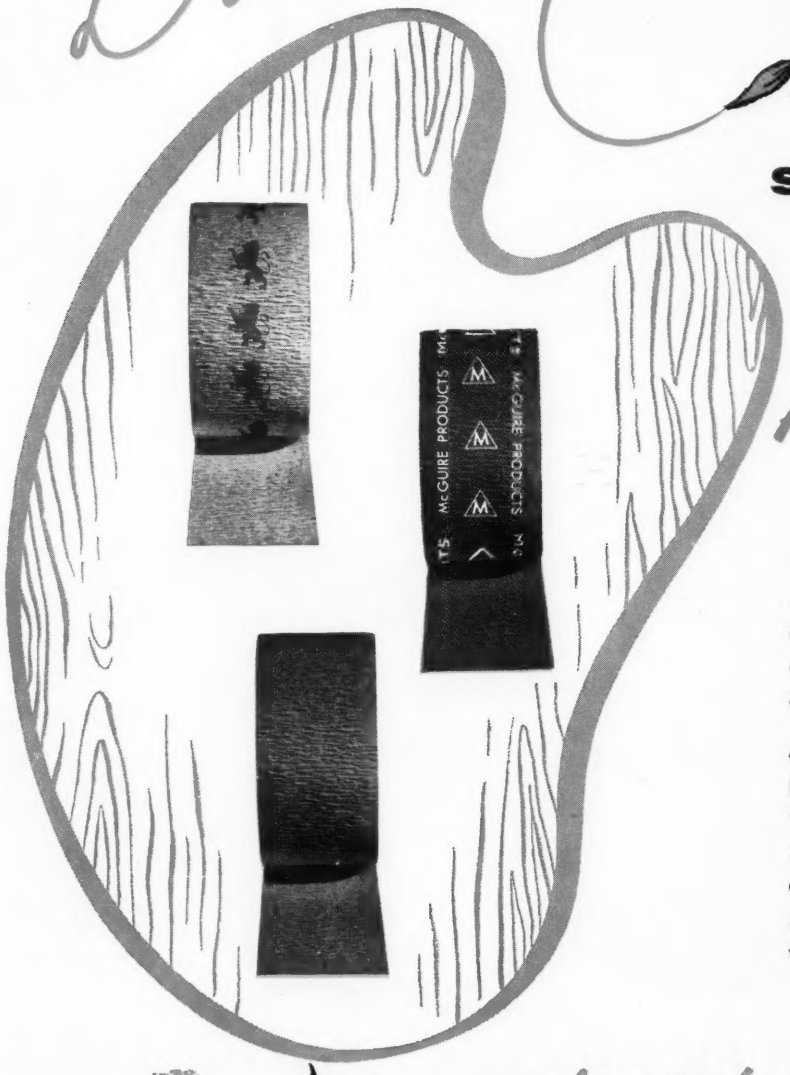


SPIRAL WRAP

by

ARKSAFE



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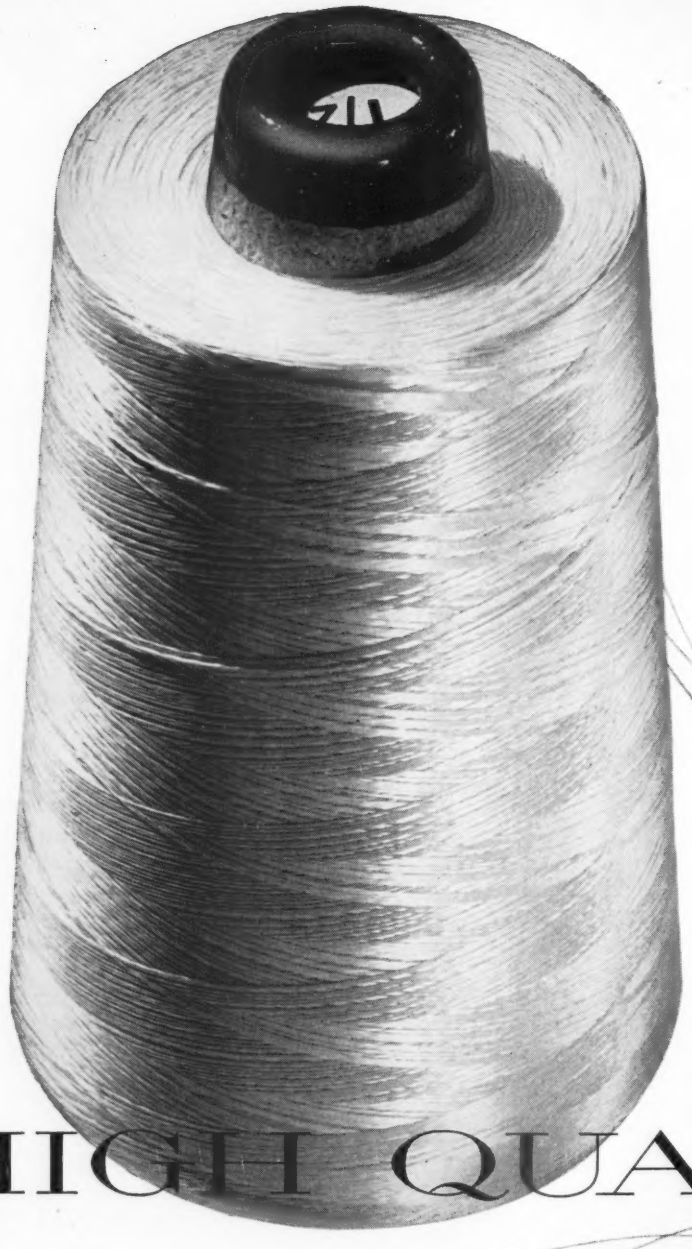

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fiber glass yarns for wire and cable insulation

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Pittsburgh yarns have proved their high quality with numerous manufacturers. If you have not yet put them to your tests, you are invited to make arrangements through our executive or district sales offices. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

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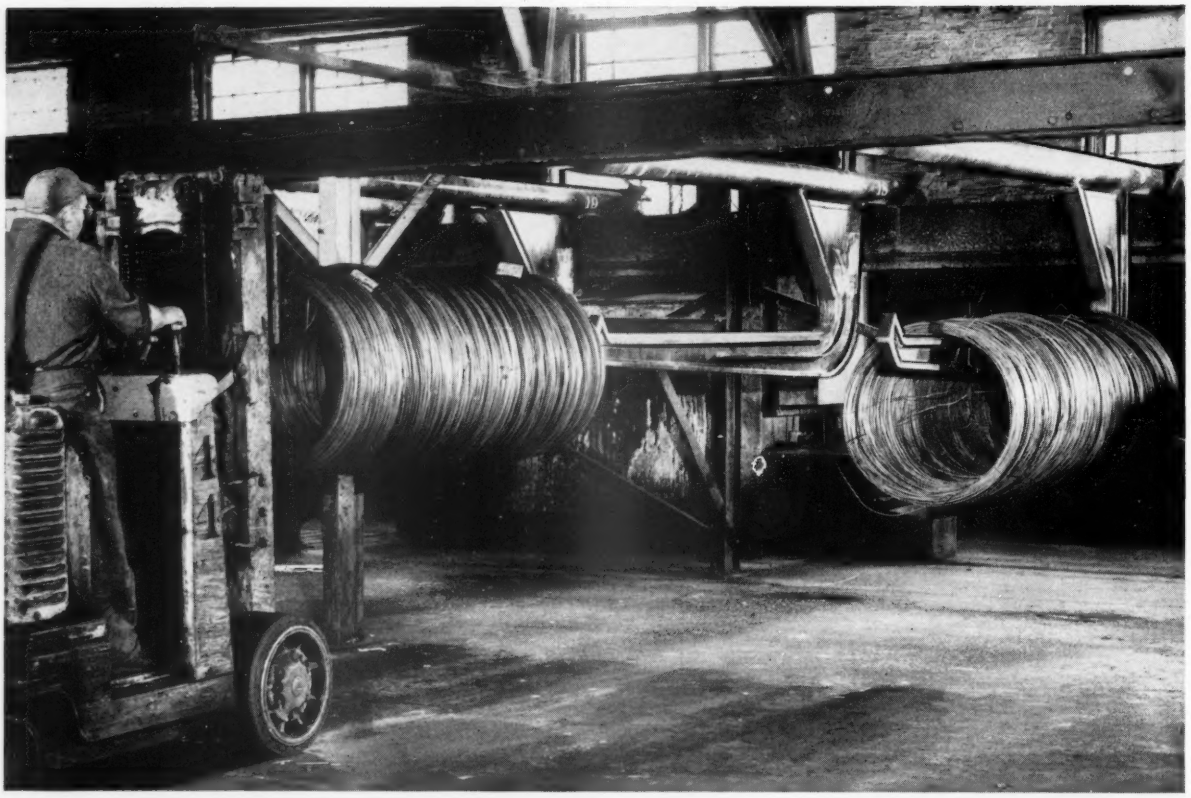

WELDCO Fabricated Hooks *For Longer Service*

Greater Strength—and Extra Protection at the "Acid Line"

IN plants and wire mills all over the country, WELDCO Fabricated Pickling Hooks are replacing heavy, old-style hooks. For plant managers and engineers are discovering that WELDCO Fabricated Hooks are stronger, lighter in weight, easier to handle, more corrosion-resistant, and carry heavier loads . . . easily and safely. And here's another important reason: Because of their superior design, WELDCO Monel or Stainless Steel Hairpin Hooks give extra protection at the "acid line," where ordinary hooks usually fail. This feature alone will add many extra years of service life!

For all your pickling and liming equipment, rely on WELDCO's ingenuity and years of fabricating experience. Whether you need conventional lightweight pickling hooks or special adaptations, WELDCO engineers design and build to meet your exact specifications. For complete pickling information, and a free copy of the WELDCO catalog, get in touch with us today.

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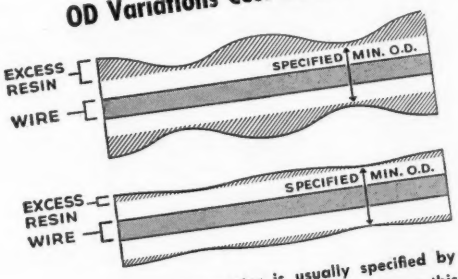
U.S.I. POLYETHYLENE PROCESSING TIPS

Choose the Right Resin For Polyethylene Wire Coating

Now that polyethylene is being widely accepted as an insulating material for wire and cable, insulated wire manufacturers and plastics producers are working closely together to provide the best insulations at the lowest possible cost. Although the only true test of a given polyethylene resin is a test run followed by a thorough evaluation of the finished wire, there are certain principles that can be used beforehand as guides. For example:

OD Variations Cost Money



Minimum Outside Diameter is usually specified by the wire customer. But a variation in OD above this minimum uses extra quantities of polyethylene resin — and cuts into extruder profits. These variations can be reduced by using resins with consistant flow characteristics as shown in the lower sketch.

Higher Production Rate Means Higher Profit

The faster a machine can be operated, the more money it can make. But higher rates require tighter controls — especially tighter control of resin properties. A resin variation that might still give a satisfactory product at moderate production rates may not be acceptable when the extruding rate is pushed to its limit. Again, consistency of resin properties is of extreme importance.

Final Properties Are All-Important

Deformation under load, stress-cracking, low-temperature brittleness and spark failure must be kept to a minimum in an acceptable wire and cable insulation. Any resin used, no matter what its processing characteristics, must pass these tests.

Why We Recommend PETROTHENE®

Because we make it — of course. But more than that, PETROTHENE does a good job for wire and cable extruders because our manufacturing process does achieve the high consistency processors are looking for. Shipment-to-shipment, bag-to-bag, and cube-to-cube, variations are held to a minimum. This high consistency enables insulated wire manufacturers to operate at highest rates with minimum OD variation when using PETROTHENE electrical grade polyethylene resins.

PETROTHENE resin properties also measure up to end-use standards for deformation under load, stress-crack resistance, low-temperature brittleness and spark failure.

Three Basic Resins Are Available

PETROTHENE 300, M.I. = 0.3; PETROTHENE 301, M.I. = 1.0; PETROTHENE 302, M.I. = 2.8. Each available with carbon black, color, JZF antioxidant, and/or non-discoloring antioxidant, compounded to your specifications.

U.S.I. Services

Literature and samples of PETROTHENE electrical grade polyethylene resins are available at your request. U.S.I. Technical Service representatives are also ready to help you with individual processing problems.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
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Here are the largest and smallest springs made from music wire at National Cash Register Co. The small springs are made of wire .006 inch in diameter and are 1/32 inch long. The large spring, about four inches long, is made of 57 coils.

Delicate adjustment during final inspection of accounting machine. Keyboard has Japanese characters.

Where Springs Check Up On Dollars

National Cash Register Uses Johnson's Music Wire to Make Variety of Springs Vital to Efficient Operation of Cash Registers, Adding and Accounting Machines

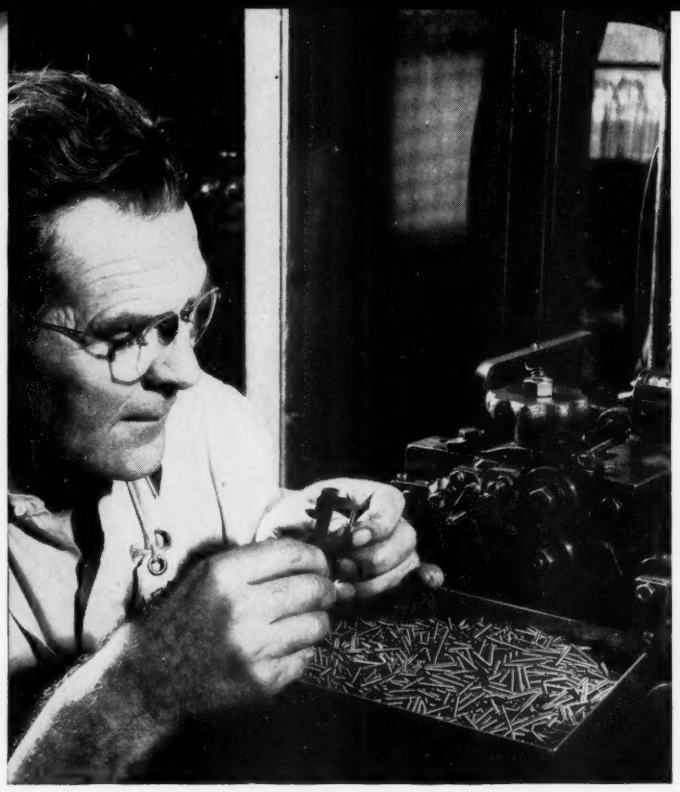
Algerian merchants in the Casbah and Eskimos in the frozen north, ring up sales on National Cash Registers. In more than 90 countries the whir and jingle of NCR machines keep track of dollars, yen, shillings, and florins—to name just a few.

Whether the NCR product is a cash register, an adding machine or an accounting machine, much of its dependability and efficiency depends on springs. These springs are carefully made of high quality music wire supplied NCR by Johnson Steel & Wire Co., a Pittsburgh Steel subsidiary.

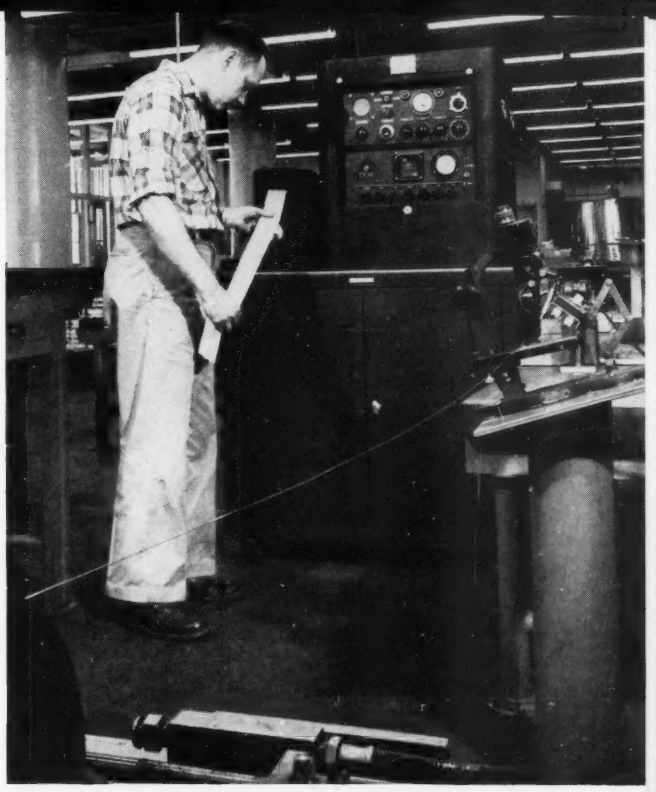
More than 2,200 different kinds of standard springs are made in the big Dayton, Ohio, plant of NCR at the rate of one million springs per week. Every one of them is tested before installation.

An intricate machine, like a Class 31 general purpose accounting machine, has more than 500 springs that help perform precise automatic accounting functions. These semi-custom-made machines must have built-in dependability.

Consider the 12 total lever lock line springs used in this machine. These springs, out of sight behind the carriage, are responsible for several different automatic functions. By setting stops in certain positions, an operator can make the machine



Coiling lever lock line springs on a No. 0 Sleeper & Hartley coiling machine. Thousands are made in a week.



Magnetic inspection on this intricate electronic device at NCR can check all the wire in a coil.

do different jobs with the selector lever springs raising and lowering plungers. If these springs vary in length or if the wire from which they are made varies in diameter, the tensile strength of the various springs will be different. That means the machine will lose the inter-balance between springs which is necessary for its operation.

Each spring is tested to make sure it will perform correctly. The 1½ inch springs are tested with a two ounce load to make sure every one will elongate to exactly 1 17/32 inches.

In NCR's Indicator Department, where a battery of 17 coiling machines makes thousands of these springs a week, 31½ inches of .011 inch wire is coiled into a 73-coil spring which is .156 inch in outside diameter. Loops on each end are formed out of the final two coils.

Because this pre-tested Johnson wire performs well on coiling machines, production is steady and rejects are low. When the finished springs are installed in accounting machines for a proof test, machine assembly proceeds smoothly without hitches due to defective springs.

To make sure that NCR customers don't lose the use of their machines through the failure of a single spring, the company insures its springs and other parts will give long and accurate job performance. Here's how.

Each coil of wire received from Johnson Steel & Wire is thoroughly tested in the Receiving-Inspection Department by a magnetic inspection device which permits a thorough check of the entire coil—not just samples from each end. Other tests are made in the Materials Laboratory.

Johnson Steel music wire, ranging in size from .005 inch to .016 inch in diameter for NCR uses, meets and exceeds National Cash Register's rigid requirements. As a result, spring rejects on the production line are virtually unknown.

NCR requires music wire that is uniform in diameter, has a fine surface that is free of seams and has the specified tensile strength. Johnson's conformance to NCR standards enables the company to make springs that will remain in balance with each other for long service.

In your plant, too, Johnson Steel wire will give you the same benefits. Johnson's wide range of wire specialties—everything from music wire to clothes line wire—will perform well on your machines and help you build quality into your product. And you can supplement Johnson products with manufacturers' wire produced at the Monessen Works of Pittsburgh Steel. A phone call today to the nearest district office will bring you prompt action.

Johnson Steel & Wire Company, Inc.
Worcester 1, Massachusetts
a subsidiary of **Pittsburgh Steel Company**
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Atlanta	Columbus	Detroit	New York	Tulsa
Chicago	Dallas	Houston	Philadelphia	Warren, Ohio
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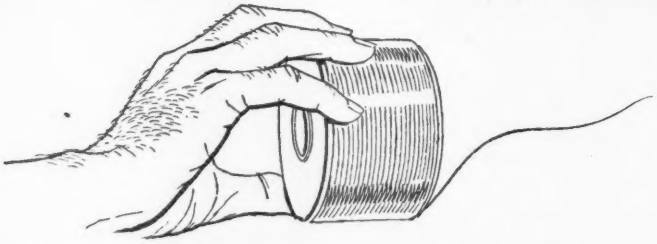
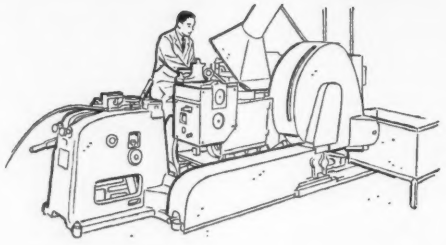
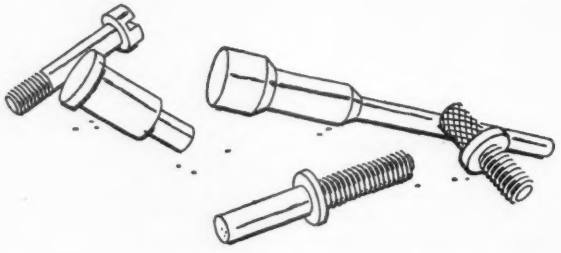
Fine wire drawing?



Cold heading?



Cold forming?



You'll save time, cut rejects, reduce maintenance costs with modern Pennsalt FOS lubricants!

Die life increases, shop cleanliness improves, finishing rejects fall off startlingly —when you use wire, rod, or tube stock *pre-coated* with Pennsalt FOS lubricants for cold working.

DRAWCOTE®, FOSCOAT®, and FOSLUBE® —the principal FOS Process chemicals— can be applied long before they're needed —in fact, many wire-stock suppliers apply FOS lubricants before shipping. There's no need to recoat stock before drawing, no need to apply wet, messy, unpredictable lubricants at the press. Your finishing rejects become a trouble of the past and your die life can be increased up to 600% . . . all because of Pennsalt FOS Process lubrication.

INVESTIGATE! Have your Pennsalt man show you how FOS dry lubricants can speed your production, save you die costs, save you metal stock. Call him or write Metal Processing Dept. 293, Pennsylvania Salt Manufacturing Company. East: Three Penn Center Plaza, Philadelphia 2, Pa.; West: Woolsey Bldg., 2168 Shattuck Ave., Berkeley 4, Calif. In Canada: Pennsalt Chemicals of Canada, Hamilton, Ontario.

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90th year

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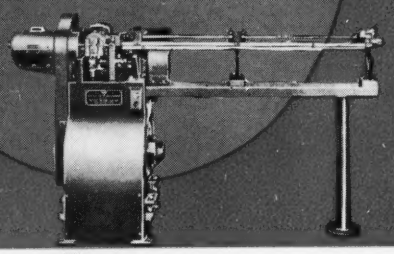
WIRE STRAIGHTENERS!



Model A
.025" - 1/16"
diameter wire

'feather touch'

SOLENOID CONTROL OF TARGET AND CLUTCH!

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high-production constant speed wire straightening and cutting machines are now equipped with "feather-touch" electrical control of target and clutch! The operator simply locks the stop rod gauge for desired length of cut; the Micro-Switch activates cut-off knife electronically, produces accurate, square, clean-cut lengths of wire!

Instantaneous clutch and cut-off cam.

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Five-Die straightening flyer!

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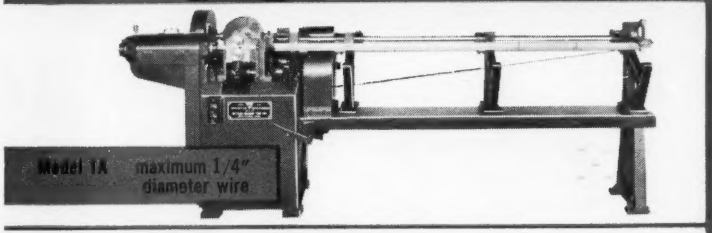
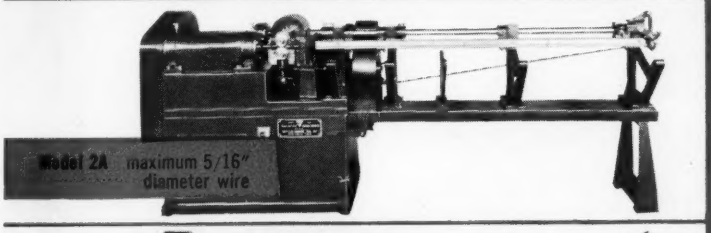
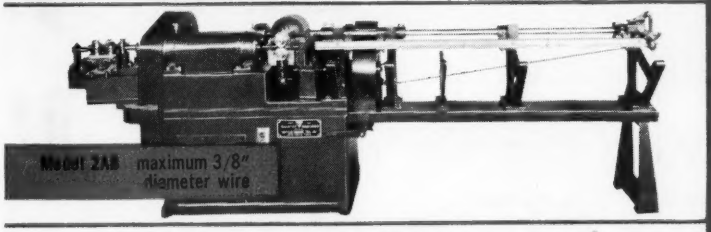
V-Belt motor drive for quiet, efficient operation!



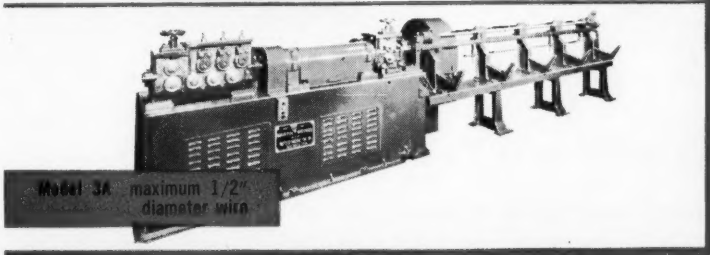
Model 1A maximum 1/4" diameter wire



Model 2A maximum 5/16" diameter wire



Model 2AB maximum 3/8" diameter wire



Model 3A maximum 1/2" diameter wire

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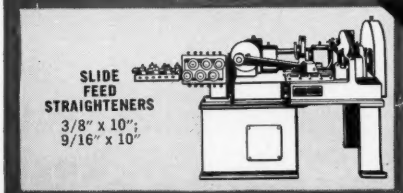
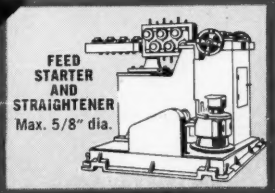
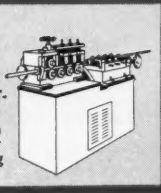
This too is **SHUSTER.**



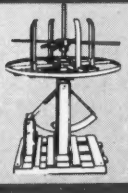
SLIDE FEED STRAIGHTENERS
3/8" x 10";
9/16" x 10"



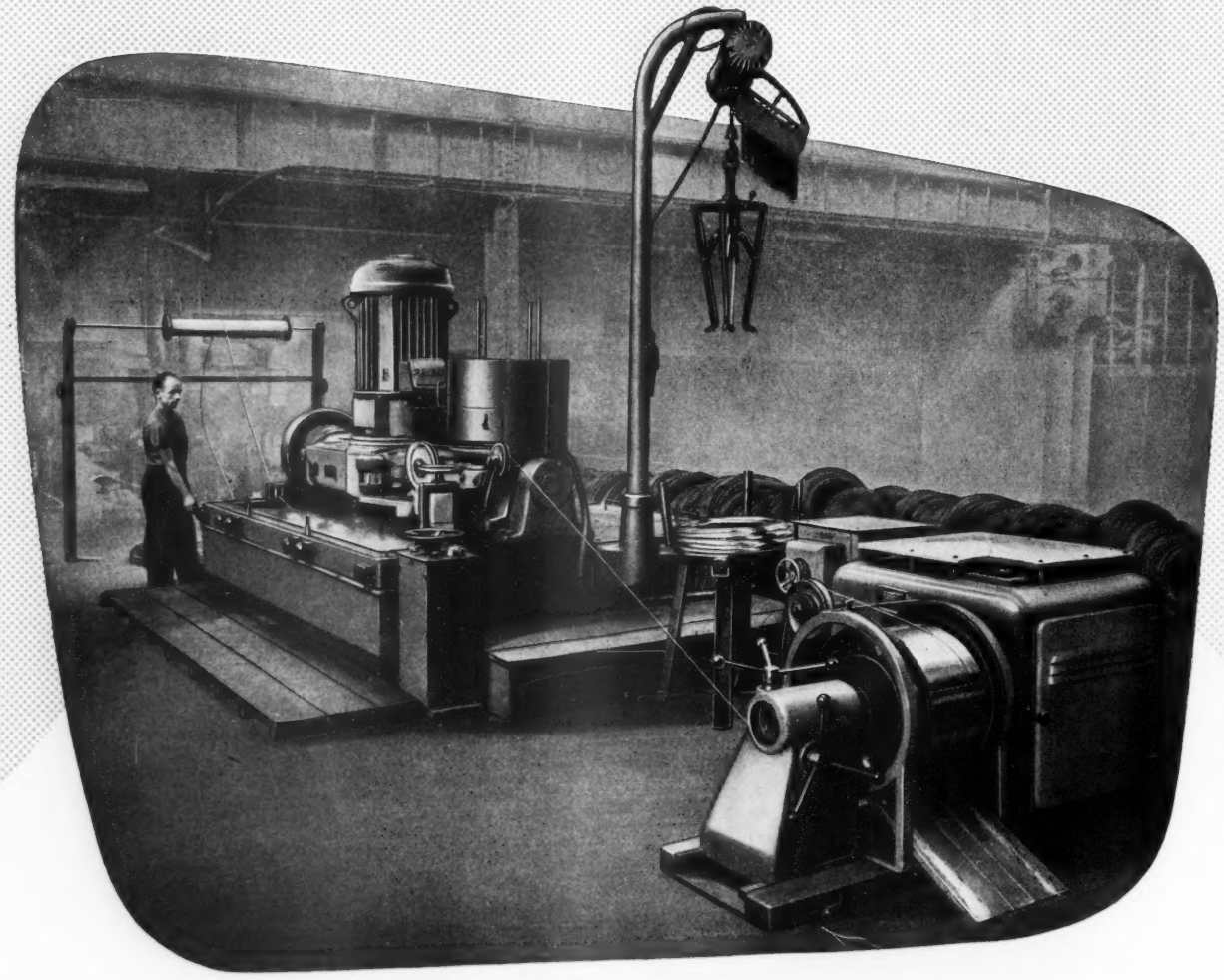
FEED STARTER AND STRAIGHTENER
Max. 5/8" dia.



TUBE AND BAR STRAIGHTENER
7/32" to 5/8" bar
1" tubing



REELS
400 lbs.



for drawing copper rod from .315″ to .137″ – .066″ or from .255″ to .118″ – .055″.

- ★ **3 different drawing speeds up to 3950 ft/min.**
- ★ **easy inserting through automatic stringing up of wire.**
- ★ **high resistance to wear of drawing cabstans.**
- ★ **reduced space requirement.**

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Sole Representative in the U. S. A.: GERMANY
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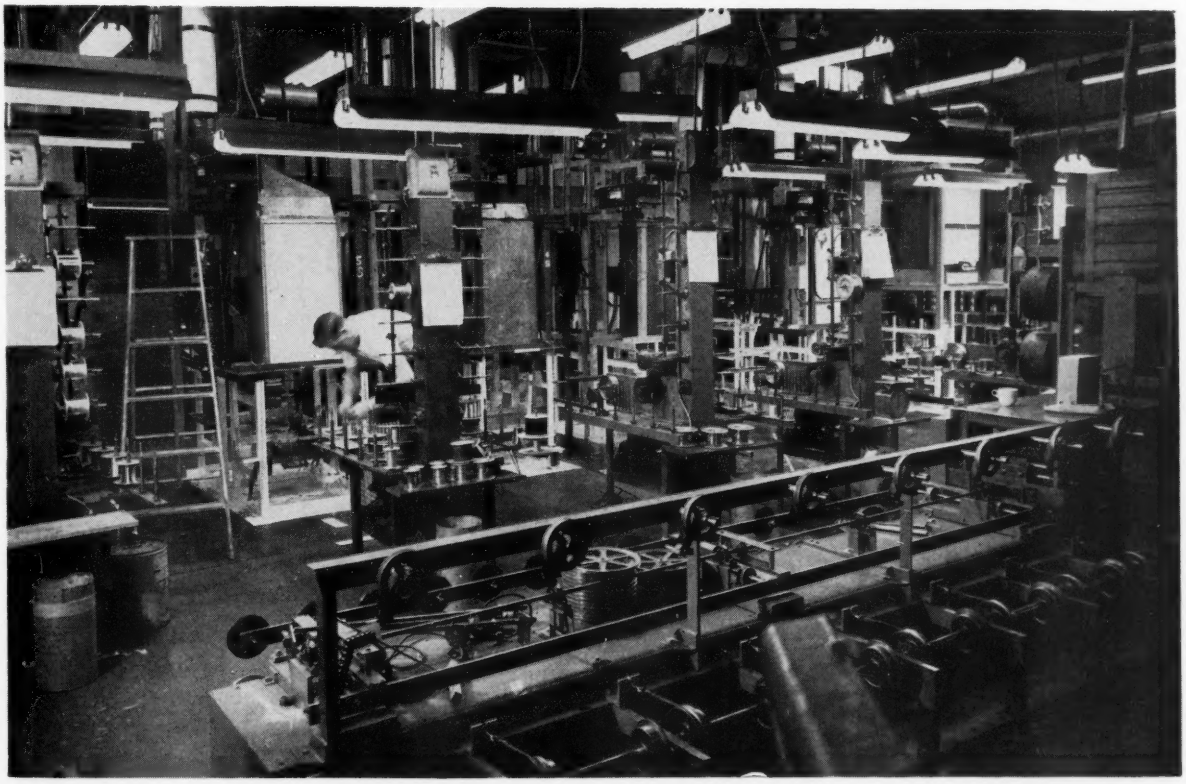
Woodside ENAMELING TAKE-UPS



Woodside Wire Enameling Take-Ups in operation in large electric wire plant. Photo shown through the courtesy of HITEMP WIRES, INC., Mineola, Long Island, New York.

WOODSIDE builds special machinery drawing fine lead, brass, bronze, copper stainless monel and precious metal wires.

OTHER MACHINES BUILT

TINNING
FINE WIRE RESPOOLING
STRAND ANNEALING
FURNACES
COIL TAKE - UPS
STRIP ANNEALERS
AND
TAKE - UPS

These Take-Ups have 12 spindles and are driven by a U.S. vari-speed motor with speed ratio of from 5 to 50 ft. per min. This unit is being used exclusively by a well-known manufacturer of Teflon insulated magnet wire.

Handles a wire size range of 46 up to 26 gage. This machine can be easily converted for single or double enamel wire take-ups. It is versatile and also can be used as a small, compact respooling device.

Dimensions of the unit are: height 82″; width, 31″ and length, 24″. This saves much floor space.

The machine is adaptable to take 5, 10 and 25 lb. spools. Equipped with ball bearing pay-offs, mounted on the machine.

Your Inquiries Are Invited

WOODSIDE MACHINERY DIVISION
of
INTERNATIONAL WIRE PRODUCTS CORP.

Greenwood Avenue • Midland Park, New Jersey

Telephone: Gilbert 4-2151

7 years' continuous service with Talide® ROLLS

(TUNGSTEN CARBIDE)

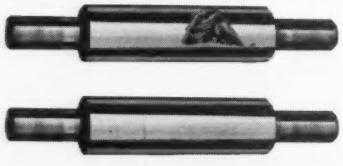
● A large Eastern Producer of oval-shape wire for loose-leaf notebook rings was experiencing excessive wear and pick-up. The high scrap rate was making the item unprofitable. Metal Carbides service engineers were called in to determine if Talide rolls could correct the trouble. Hi-carbon wire was being reduced on a 2-hi cold rolling mill to an oval shape .100" thick x .156" wide. Considerable stress and pressure was required to deform the wire to proper shape.

Our engineers designed a roll incorporating a carbide sleeve having 3 grooves ground in periphery and mounted to a special alloy steel arbor. The initial pair of rolls was installed in 1948 and has been in continuous service ever since. Due to their extreme hardness it has not been necessary to remove them from the mill during this 7-year period—not even for a regrind! Size and shape of wire has been perfectly maintained. Customer has since installed similar rolls on all their mills.

SUPERSET GRINDING WHEEL

The Superset diamond grinding wheel was specially developed for grinding carbide rolls to highest possible surface finish and luster. Made of 4-8 micron size diamond dust, it imparts a surface finish far superior to any other commercial wheel. Available in sizes up to 25" diameter.

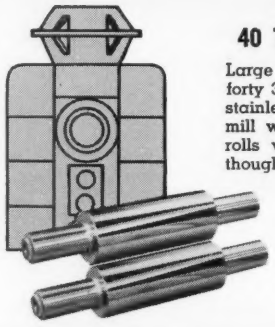
EXCLUSIVE REPAIR SERVICE



Broken or damaged carbide rolls can be re-worked to first class condition with all defects eliminated at one-half original cost. Only Metal Carbides offers this service—because of its exclusive hot press method.

Metal Carbides Corporation,
Youngstown 12, Ohio.

Send for new 84-page catalog 56-G

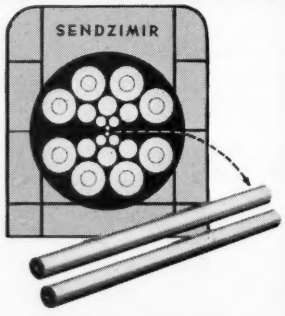


40 TIMES MORE TONNAGE

Large Steel Producer cold rolls forty 3,000 lb. coils (60 tons) of 18-8 stainless steel, series 300, on 4-hi mill with one pair of solid Talide rolls with no surface wear, even though strip work hardens to 50 Rockwell "C" in one pass. Flatter, smoother strip produced—even when rolling intermittent widths. 40 pairs of steel rolls were required previously to produce same tonnage.

ROLL LIFE INCREASED 278 to 1!

All users of Sendzimir rolling mills have adopted Talide work rolls because operating results have been phenomenal, far surpassing all expectations. Tremendous production runs are commonplace with mill after mill reporting increased tonnage runs between roll changes of 278-1, 179-1, 82-1, etc.



Talide Rolls are made in lengths up to 100", diameters up to 25", and up to 5000 pounds by weight.

METAL CARBIDES CORPORATION

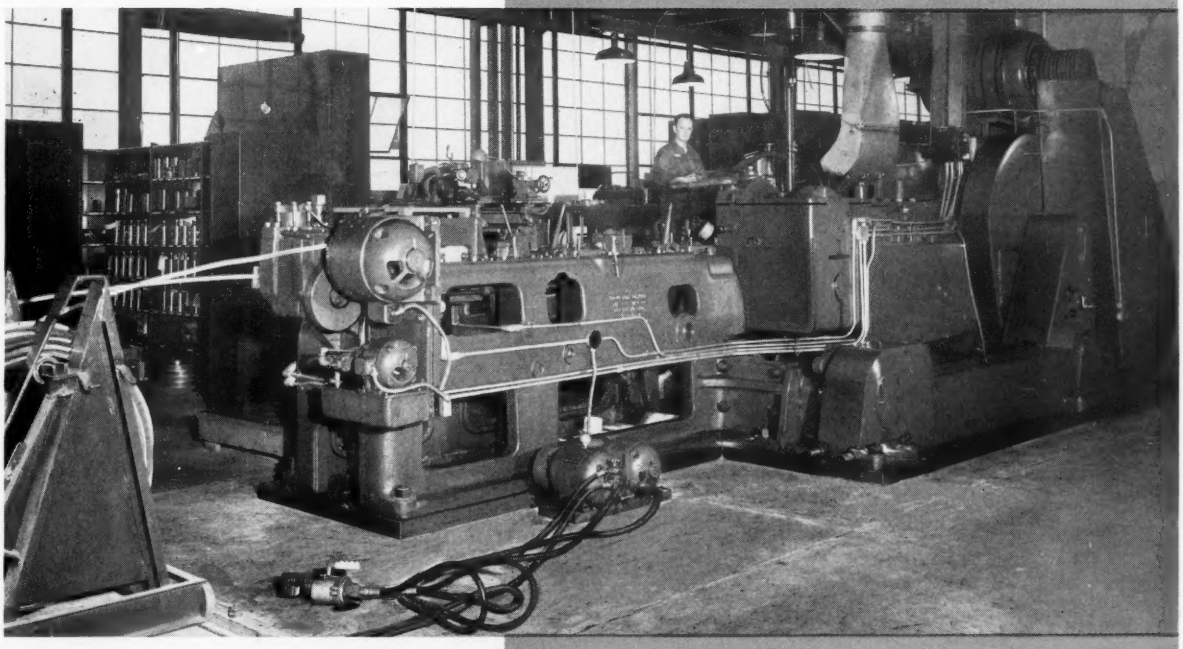
TALIDE®

YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

Ajax-Hogue Wire Drawers

Built in Eight Sizes *for* All Cold Headers



Courtesy of Lake Erie Screw Corp., Cleveland, Ohio

AJAX-HOGUE WIRE DRAWERS Can be attached to any make Cold Heading Machine with which we are familiar.

It is a complete Wire Drawing unit driven from the header by roller chain. Built in eight sizes, it can handle all diameters of rod from the smallest available, namely No. 5 size rod up to a maximum of $1\frac{1}{2}$" diameter.

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IMPROVED PRODUCTS
LONGER DIE LIFE
CLOSER WIRE TOLERANCES
STRAIGHT WIRE BLANKS

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V-R NEW Cylindrical nib and improved method of assembly insure high degree of concentricity.

V-R . . . First in producing the only Tantalum-Tungsten carbide developed specifically for Drawing Dies.

V-R . . . First to manufacture Carbide Dies with preformed rough cored back relief.

V-R . . . First to furnish Carbide Dies rough cored to finish at hole sizes below .010".

WRITE TODAY for NEW Vascoloy-Ramet Die Catalog VR-461.

The New V-R Die Catalog gives complete ordering information on all V-R Dies for drawing wire, rod, bar and tube.

VASCOLOY-RAMET CORPORATION

The Wire Outlook

While some of the steam of the boom has been spent, businessmen are evidencing confidence and it seems quite likely that high levels of activity will carry along for some time to come.

There had been much question as to what would happen if the President decided not to run. His expression of willingness to serve for another four years produced a great sense of relief and there followed a practical demonstration of how people felt in the market's upsurge after the announcement. The political battle will be bitter and the announced tactics of his opponents are some foretaste of the type of leadership the country could expect should the electorate decide upon a change—which, Heaven forbid at this point in our recovery from New-Fair Deal policies.

Although the overall picture looks promising, two factors are not too rosy—the declining farm income and the greatly lowered auto production. The first quarter figures for the latter show that about 400,000 fewer units were produced in 1956 than in 1955. The question naturally arises as to whether the auto makers are pricing themselves out of a market in the competitive power and equipment race. The industry is counting on Spring sales to improve its lot.

Retail sales are up 2% over last year and manufacturers in general are getting more new orders than they are able to fill promptly. Steel companies have announced new plans for more and better mills that will increase ingot capacity by 15 million more tons in the next three years. Except for the Far West and South, steel mills are operating in excess of rated capacities. About 1.2 billions will be spent for expansion and improvements this year. United Steelworkers are readying for new demands that will make another price hike inevitable.

The gross national income for 1955 was up 7% over 1954 with a total of 387 billion dollars. The last quarter of 1955 showed a rise to a 397 billion rate, 8% over the same period in 1954. That's about the pace at which business is operating at present. Prices last January were 4% up over the preceding January, with personal incomes 7% higher, running at a 312 billion dollar rate. Total employment in January was 62,900,000, the highest ever recorded for the month. Unemployment stands somewhat under 3 million.

Are prices too high? Possibly the extraordinary earning of the large industrial concerns would indicate that they are. Gas price wars are rampant and the Federal Trade Commission suspects that the cut prices may represent true values, but the oil lobby has been able to circumvent any investigation. It would seem that the spread of "discount houses" is a further indication that many retail items are priced too high.

Orders for durable goods, the continued high levels of residential and industrial building and public works are all contributing to keeping business activity high and are offsetting the soft spots in the economic picture.

Cold finished bars are fairly available. Order books are well filled, but in some spots demand exceeds supply. Practically all markets report good demand for manufacturers' wire, although the demand for wire rods is making deliveries a little slow.

Welded wire fabric production is operating at capacity, with demand running high. Pressure on some grades of spring and cold heading wire has eased, because of the lighter automotive orders, but buyers are continuing to build inventories against future requirements. Apart from the auto industry, other classes of fastener consumers are buying in substantial volume. Merchant wire products are expected to be in full demand again this Spring.

With rising costs, the need for greater automaticity will increase. At the same time, a demand for closer tolerances is making a great deal of old equipment obsolete.

The machinery people are the key to much that will keep prices from advancing as fast as wages. This should be a good year for those concerns who are on their toes and able to offer equipment that saves a little labor here and shaves costs a little there.

In fact, the outlook for business generally is favorable.

—from the Editor's Desk

You have to get up early in the morning

for a drawing powder as good as

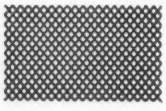
Steelskin AM

DRY-DRAWING POWDER

for dry-drawing steel for rope

tire bead

poultry netting



wire screen

springs and nails

For dry-drawing galvanized wire, too.

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WIRE
AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 31 April, 1956 No. 4

The Wear of Diamond Dies

by L. Schultink, H. L. Spier and A. J. van der Wagt
Philips Research Laboratories
Eindhoven, Netherlands

The great value of the diamond is due to its tremendous mechanical hardness and resistance to wear. These two properties in particular have won it an unassailable position among materials for tools. Apart from its use for cutting tools, for bearings and as an abrasive, the diamond has proved of great value for drawing dies, for producing wire from very hard metals such as tungsten and molybdenum. Even diamonds, however, are subject to wear under continuous use. Special research in this field gives sufficient evidence to assume that the wear on diamond drawing dies can be reduced to a minimum by employing the most suitable crystallographic orientation of the drawing cone.

This paper originally appeared in the Philips Technical Review and is published here through the courtesy of the North American Philips Company, Inc.

Introduction

From a technological point of view, diamond is a most useful material since it is the hardest of all known substances. Owing to this property its value as a material for tools is unsurpassed: 80% of the yield of the diamond mines is used for industrial purposes and only 20% finds its way into the jeweler's showcase.

★ ★ ★

In this paper we shall confine ourselves to the diamond drawing dies for the manufacture of fine wire from very hard metals, such as tungsten. Dies of any other material are not suitable for drawing very hard metals into wires of small diameters except at the cost of enormous wear on the dies.

★ ★ ★

When a diamond is to be used as a drawing die, a hole of the desired profile and minimum diameter has first to be drilled through it. This can be accomplished by a special process; holes having a purely circular cross-section can be obtained in all diameters. If the diamond is to function satisfactorily as a drawing die, the minimum diameter of the hole should not change and the aperture should retain its circular shape. This ideal state, however, cannot be maintained in practice; even diamonds are subject to some wear during use. After several thousands or tens of thousands of yards of tungsten wire have passed through it, the shape of the hole is found to have changed considerably.

★ ★ ★

The extent of this wear as well as the ultimate shape of the hole depends on several factors, among which may be mentioned the condition of the outer layers of the material to be drawn, the lubricant used and the temperature. Even if these factors are kept constant, remarkable differences in the nature and the rate of wear may occur. This is due to the fact that a diamond always contains impurities and inclusions that may influence its wear. Moreover, wear will occur in different structural planes, according to the direction of the drilled hole with respect to the crystal orientation, and it is well-known that the resistance to wear of diamond depends greatly on the crystallographic orientation of the faces that are subjected to the wear.

★ ★ ★

This effect will be dealt with in this article.[1] Before considering the wear during the wire drawing process we shall give a brief summary of the resistance to wear of diamonds in general.

Effect of Crystallographic Orientation on the Resistance to Wear of Diamond

In the diamond-working industry it is a well-known fact that diamonds can be ground and polished far more easily in certain directions or on certain faces than in other directions. The wear resistance of diamond shows a pronounced anisotropy and the directions of minimum wear resistance are closely related to the crystal structure.

1) **This subject will be treated in greater detail in a paper by the same authors to be published shortly in Applied Scientific Research.**

Diamond crystallizes in the cubic system. The arrangement of the carbon atoms in an elementary cell is characteristic, and other solids having a similar arrangement are often said to have the diamond structure. In such materials the binding forces between the atoms are of the valence type. They have the important property of showing pronounced preferred directions in space. The carbon atoms in the diamond lattice each have four nearest neighbors, arranged tetrahedrally around the central atom, the four bond directions being thus arranged symmetrically in space, as shown in Fig. 1. The carbon atoms are situated at the

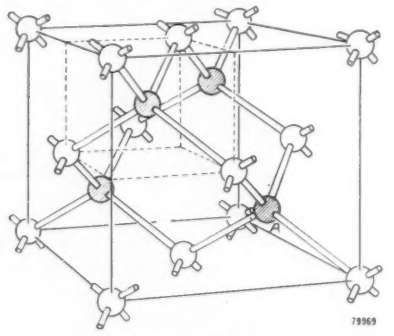

Figure 1. Cubic unit cell of diamond. * * * *

corners and in the face-centres of a cube, as with the ordinary face-centred structure, but apart from these the cell contains another four atoms. If the cube is divided into eight similar small cubes, each having half the edge of the unit cell, then these four additional atoms (hatched in fig. 1) are to be found in the centres of four of the small cubes, which are so arranged that any two cubes have only one edge in common. The above-stated condition that any given carbon atom is tetrahedrally surrounded by four neighbors, is thus satisfied.

★ ★ ★

The hardness of the diamond is largely due to the fact that great energy is required to liberate one or more carbon atoms from their tetrahedral surroundings, since this involves the breaking of several bonds and disruption of their symmetry, which is essential in valence-bond crystals.

★ ★ ★

The orientation of the boundary planes of the natural diamond is as a rule simple and nearly always occurs in three forms viz:

a. **Along the cube faces, termed (100)-planes in the crystallographic notation.**
b. **Along the rhombic-dodecahedral faces or (110)-planes. These are planes through a cube edge and parallel to the face diagonal of a plane perpendicular to this edge.**
c. **Along the octahedral planes or (111)-planes, i.e. planes perpendicular to a body diagonal of the cube.**

★ ★ ★

When the various diamond faces are ground (neglecting for the moment the **direction** of grinding) it is found that the three planes most commonly occurring show different wear resistance. The rhombic- dodecahedral faces are as a rule most easily ground, i.e. the material is readily removed by a force acting in the rhombic-dodecahedral plane. The cube faces are harder to deal with, and the octahedral faces are the most wear-resistant, which means that a force acting in the octahedral plane removes only very little material.

★ ★ ★

In a given plane, however, the **direction** of grinding is also of importance. Each type of plane is found to have one or more preferential directions, along which the wear resistance is smallest. In the (110)-plane this preferential direction is along the cube direction in that plane, in the (100)-plane both cube directions are equally preferential, whereas in the octahedral planes the orthogonal projections of the three cube directions in that plane are the directions of preference. Fig. 2 shows the fundamental orientations of minimum wear

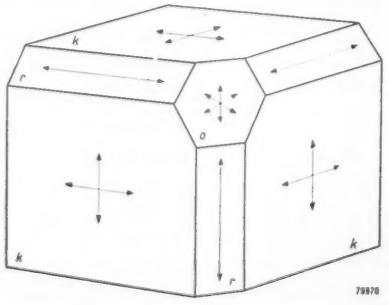

Figure 2. Schematic diagram of preferred orientations for diamond grinding. The preferred directions on the various crystal faces are indicated by arrows whose lengths are proportional to the ease of grinding. Cube planes are indicated by k, rhombic-dodecahedral planes by r, and octahedral planes by o. (Diagram taken from the article referred to in 2).) * * * * * * * *

resistance: i.e. the directions along which the diamond crystal is most easily ground.

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For directions other than the preferential, the ease of grinding may well be approximated by:

$$S = A \cos^2 \theta, \ldots\ldots (1)$$

in which **A** represents a constant depending solely on the nature of the grinding plane. According to the foregoing, **A** will be large for (110)-planes and small for (111)-planes. θ indicates the angle between the actual and the preferred grinding directions.

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The cohesion of the atoms in a diamond crystal can be broken not only by grinding, but also by cleavage. The octahedral plane proves a favorable cleavage plane, which means that a force applied so that it acts perpendicular to the octahedral planes will effect a breaking of the bonds relatively most easily. As in the case of grinding, just the opposite applies to forces acting parallel to these planes.

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The explanation of this anisotropy in diamond wear, according to Stott[2] and others is to be found in the nature of the directional bonding forces between the atoms. As an example we shall consider here only the case of the wear resistance of the rhombic-dodecahedral plane (110)-plane. Fig 3. shows the configuration of the atoms in a dia-

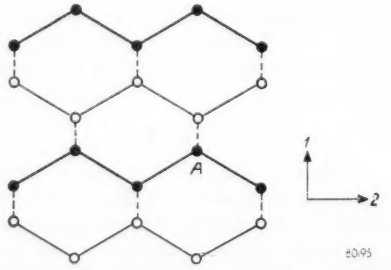

Figure 3. Configuration of atoms in a diamond lattice as seen perpendicular to a rhombic-dodecahedral plane. The black dots represent the surface atoms in the rhombic-dodecahedral plane; the circles represent atoms in the underlying rhombic-dodecahedral plane. The full lines show the bonds parallel to the plane of the drawing, while the dotted lines represent the bonds between atoms of the two layers. Arrow 1 indicates the cubic direction, and arrow 2 the direction of a face diagonal. Atom A (similarly marked in figure 1) will more easily be removed by a force parallel to arrow 1 than by a force parallel to arrow 2. (Cf. the article referred to by 2).) * * * * * * * * * *

mond lattice as seen from a direction at right angles to this plane. The atoms indicated by the black dots lie in the plane of the drawing, and therefore in the rhombic-dodecahedral plane to be ground; the circles show the atoms in the first layer beneath this plane. The connecting lines show the interatomic bonds; the full lines are those parallel to the plane of the drawing and the dotted lines show the bonds with the deeper layer. For the sake of clarity the atom A corresponds to that denoted by A in Fig. 1. It appears that atom A can be more readily removed by a force in the direction of arrow 1, i.e. in the cube direction, than by one acting along arrow 2 which is perpendicular to it. The cube direction is consequently to be preferred in grinding.

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Similar considerations will satisfactorily explain other directions of preference with respect to wear and cleavage.

Wear on a Drilled Hole in the Course of the Drawing Process

Let us now return to the wear on the drawing dies. There is conclusive evidence to justify the assumption that the boundary surface of the effective part of the drawing hole is composed of submicroscopic elements of crystal planes belonging to each of the above-mentioned categories. Let us first consider a hole drilled in the direction of the cube edge, i.e. at right angles to a cube face. The hole will then probably be bounded by cube planes k and rhombic-dodecahedral planes r (Fig. 4). According to our explanation these r-planes, if ground in a cube direction (as occurs, in this particular case, when wire drawing), will wear faster than any other crystal plane. The rhombic-dodecahedral planes will thus show the greatest rate of wear and the hole cross-section will assume a more or less square shape. Wear of the cube faces is also implied in the assumption of this shape. As these are also relatively easily wearing the process proceeds fairly quickly.

[2]) W. Stott, National Physical Laboratories, Collected Reports 24, 3-55, 1938.

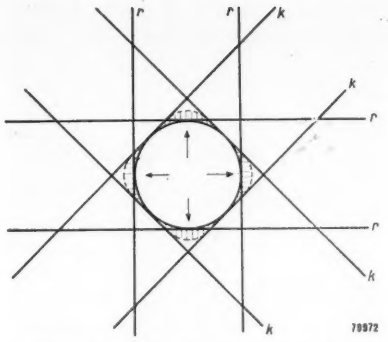

Figure 4. A hole drilled perpendicular to a cube face is bounded by cube planes k and rhombic-dodecahedral faces r, as indicated schematically. Wear will occur mainly in the r-planes, so that the aperture will eventually assume a square shape. * * * * * * * * * *

If a hole is drilled perpendicular to a rhombic dodecahedral plane, it will be bounded by crystal planes of all the three types discussed (Fig. 5). None of the directions of

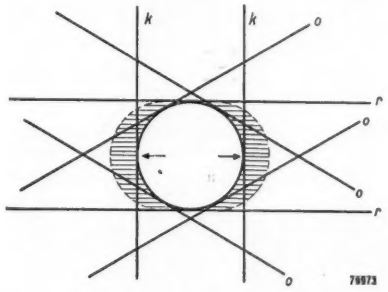

Figure 5. A hole drilled perpendicular to a rhombic dodecahedral plane is surrounded by crystal planes of all the three main types k, r and o (shown schematically). Wear will occur mainly in the cube planes, so that the aperture will tend to assume an oval cross-section. * *

easy wear now coincides exactly with the drawing direction. To ascertain which type of plane has the quickest rate of wear, it is necessary to decide which plane has the highest value of S (equation 1). In this case the cube faces are those subject to the greatest wear. As shown schematically in Fig. 5 the aperture will gradually become oval, with the major axis perpendicular to cube faces (which implies parallel to a cube direction). The rate of wear will be slower here than in the first instance, since no grinding takes place along a preferential direction.

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If the hole is drilled perpendicular to an octahedral plane, it is surrounded by rhombic-dodecahedral planes, all equivalent as regards their orientation with respect to the drawing direction (Fig. 6a).

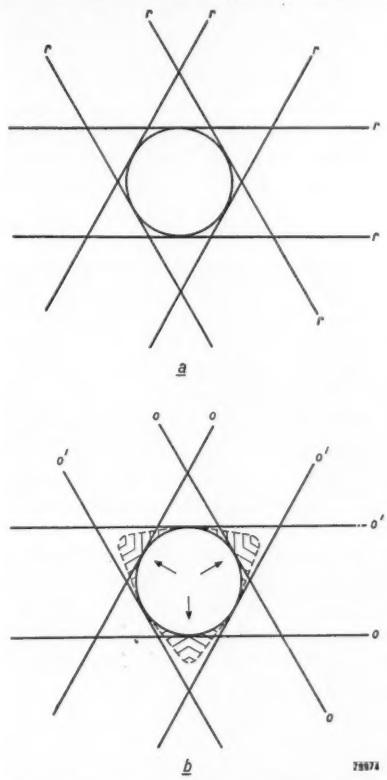

Figure 6. a) A hole drilled perpendicular to an octahedral plane is surrounded by rhombic-dodecahedral planes r, all wearing at a uniform rate. b) It is supposed that, in the course of the wearing process, these planes largely give way to the octahedral planes o and o', of which only those marked o will wear because of their favorable orientation with respect to the drawing direction. The ultimate cross-section of the hole will be triangular. * * * * * *

It might, therefore, be expected that the aperture would become hexagonal, all faces showing a uniform wear. It has been found, however, that the drilled hole with this orientation often assumes a triangular cross-section.

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A wholly satisfactory explanation of this phenomenon has not yet been found. It is possible that the rhombic-dodecahedral planes surrounding the hole, ultimately give way to octahedral planes (Fig. 6b). Although not quite parallel to the drawing direction, they lie at a relatively small angle to it. The wear on these octahedral planes, half of which lie at a small positive angle and the other half at a negative angle with the drawing direction, will now apparently predominate. More wear will occur on the octahedral planes o "along" which the grinding action takes

place than on those marked U' "into" which grinding occurs. This provides a qualitative understanding of why the aperture gradually becomes triangular. Owing to the predominance of octahedral planes and to the relatively unfavorable orientation of the grinding direction on them, the rate of wear will be very slow, much slower indeed than in the two previous cases.

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The conclusions regarding the symmetry of the ultimate shape of the drawing aperture can also be reached along entirely different lines of reasoning, since this shape will always be determined by the anisotropy of the diamond crystal. Drilling along a three-fold axis will produce a hole which wears to a cross-section of three-fold symmetry, etc. An altogether different matter is the **rate** of wear; information on this can only be gained by ascertaining **which** planes are being ground.

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The above considerations lead to the theoretical conclusion that drawing holes should preferably be drilled as nearly as possible perpendicular to an octahedral plane in order to incur the minimum amount of wear.

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Experimental research into the wear resistance as a function of the crystallographic orientation presents considerable difficulties, particularly owing to the fact that the homogeneity of diamond crystals used for wire-drawing dies is far from perfect. Only a large-scale statistical investigation can provide the solution. For certain applications, in which large numbers of diamond dies are used, research of this kind may lead to a considerable reduction in diamond wear.

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One aspect of this research may be mentioned here, viz. the determination of the orientation of a die from its X-ray diffraction pattern. The recently developed X-ray image intensifier[3] permits of a direct visual observation of this diffraction pattern; it is no longer necessary to record it photographically.

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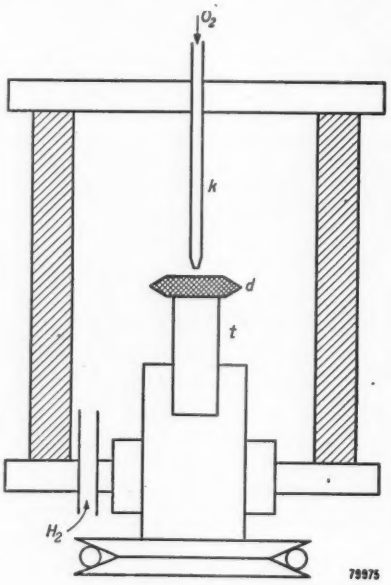
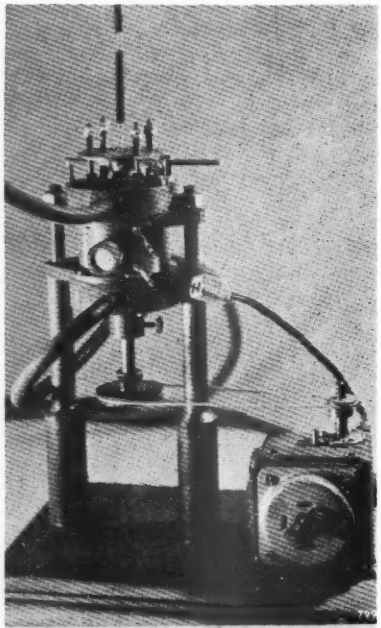
As a further check on the above-mentioned conclusions, attempts have been made to attack diamond in a different way, namely by a process of etching or, more strictly, of burning. The results thus obtained are found to confirm the theoretical approach.



a



b

Figure 7. a) Apparatus for the etching of a diamond by burning with oxygen. The diamond d is fitted on a rotatable table t. A movable silica nozzle faces the upper surface of the diamond. The whole assembly is placed inside a furnace supplied with a hydrogen atmosphere; the temperature inside the oven is approximately 850 °C. A jet of oxygen is blown onto the diamond through the silica tube.

b) Photograph of the apparatus.

Etching of Diamond Faces

Diamond, as is known, is totally inert to the conventional pickling and etching reagents. In order to study the etch patterns on the three main faces of diamond, a special method has therefore to be applied.

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The diamond under test is fixed in a rotatable jig inside an electric furnace (Fig. 7). The face to be etched lies horizontally and is faced at a short distance by the narrow jet nozzle of a silica tube set in a movable mount. By suitable movement of the nozzle, combined with rotation of the diamond, the whole surface of the latter can be covered. Inside the oven the temperature is maintained at 800-900°C, whilst an atmosphere of hydrogen is supplied to prevent combustion of the diamond. A fine jet of oxygen blown out of the moving nozzle onto the diamond then has a pronounced "etching" effect (actually a burning).

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It has been found that the time required to obtain the same etching effect on a (111), a (110) and a (100)-plane is quite different. This is shown in the following table, which applies to a certain uniform depth of etching.

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It is clear that the rhombic-dodecahedral plane (110) is most easily etched whilst the octahedral plane (111) presents most difficulties. The removal of carbon atoms, therefore, both by grinding and by burning, is most easily effected from the rhombic-dodecahedral

Crystal plane	Etching time in minutes
(110)	5
(100)	8
(111)	11½

[3]) M. C. Teves and T. Tol, Electronic intensification of fluoroscopic images Philips tech. Rev. 14, 33-43, 1952/53.

plane and is most difficult from the octahedral plane.

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If etching takes place with the diamond rotating and a stationary jet, so that the burning is localized, it is found that the etching patterns, formed on the various diamond faces are, of the same form as the corresponding drilled holes worn in the course of wire drawing. The etching patterns obtained are shown in Fig. 8. The square shape of the hole burnt into the cube face can be clearly distinguished from the oval crater in the rhombic-dodecahedral face and the triangular one in the octahedral face. These symmetries are entirely similar to those shown ultimately by the drawing holes in the various orientations (Figs. 4, 5 and 6) and in accord with that to be expected from the crystal anisotropy.

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If the completely etched surfaces are examined under the electron microscope, then the cube faces are found to be covered with quadrilateral pyramids (Fig. 9a). The rhombic-dodecahedral faces resemble something like a Jura landscape (Fig. 9b), but the orientation of the valleys clearly coincides with the crystal directions: the valleys are oval, with the major axes lying in the cube direction. On the octahedral faces trilateral pyramids have appeared, bounded by cube planes (Fig. 9c).

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These photographs illustrate very well what happens during a polishing or grinding process.

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When grinding takes place along the (111)-plane the trilateral pyramids will soon disappear because of the comparatively easy cleavage along the (111)-planes. After all pyramids have disappeared a perfectly smooth plane is left, giving very little foothold for further grinding. The octahedral face is hence highly resistant to grinding.

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On the (110)-plane new mountain ridges continue to appear be-

Figure 8. Etch holes on the major planes of diamond: a) on a cube face. b) on a rhombic-dodecahedral face. c) on an octahedral face.

cause these cannot be attacked along a direction of easy cleavage and wear will continue, with a far greater uniformity. There will, however, be a great difference according to whether the grinding action occurs across or along the mountain ridges: in the latter case, wear is less readily achieved.

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When a cube face is ground new pyramids will continue to appear. These new pyramids cannot disappear by cleavage because no plane of easy cleavage is favorably orientated. The resultant rough surface is relatively easily ground.

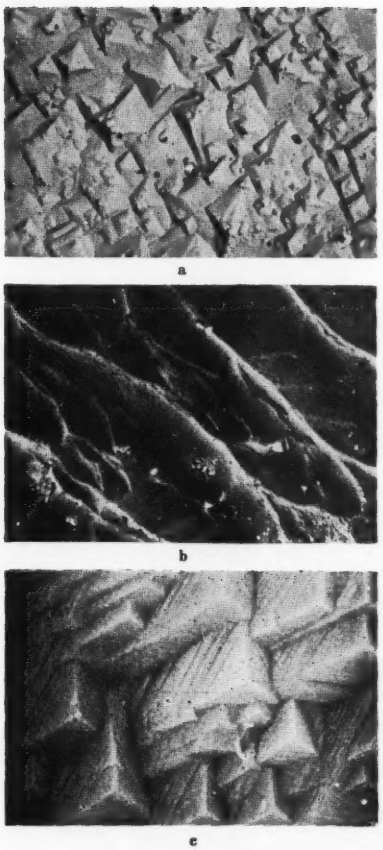

Figure 9. Electron photo-micrographs of etched crystal faces of diamond. Enlargement 10,000 x. a) cube face. b) rhombic-dodecahedral face. c) octahedral face.

Summary

Summarizing, we may therefore claim that the picture obtained by etching and made visible by the electron microscope, fully confirms the theoretical picture of the wear resistance of the three major planes. Practice, however, must finally decide whether drawing dies with the theoretical optimum orientation of the hole will indeed show the least wear. As already mentioned, this will require an extensive statistical investigation, in view of the effects of factors other than the crystal orientation.

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Theoretically it may be expected that the wear in diamond dies will greatly depend upon the crystallographic orientation of the drilled hole, on account of the crystallographic arrangement and the special type of bond between the carbon atoms. Because of this, there are certain preferential orienta-

(*Please turn to page* 476)

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4½"	3" 3¼" 3½"	2½"	.635"
4½"	6"	2½"	.635"
5"	2¾" 3"	3.880"	.531"
6"	3" 3¼" 3½"	3½"	.635"
6"	3" 3¼" 3½"	3½"	3"
6"	6"	3" or 3½"	.635"
6"	6"	3½"	3"
6½"	3" 3¼" 3½"	3½"	.635"
6½"	3" 3¼" 3½"	3½"	3"
6½"	6"	3½"	.635"
6½"	6"	3½"	3"
7"	3" 3¼" 3½"	3½"	.750"
7"	6"	3½"	.750"
8"	3½" 6" 6¼"	4"	3" or 3¹¹⁄₁₆"
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Mechanical Descaling of Wire Rod

by Clemens H. Eisenhuth, Engineer
Felten & Guilleaume Carlswerk
Koehln-Muehlheim, Germany

This article, which was published in Stahl und Eisen, has been translated and abbreviated by Dr. Jerome W. Howe, Worcester, Massachusetts. It presents a very complete picture of the accomplishments of the German wire industry in the growing use of mechanical descaling processes.

The problem of control of pollution of German watercourses by industrial wastes is driving German wire manufacturers more and more toward the substitution of mechanical descaling for chemical pickling. As yet mechanical descaling is in a far from acceptable stage of development, but there are already cases of present application to particular kinds of wire, and as the process becomes progressively more satisfactory, other extensions of its employment will surely be attempted.

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This article reports the results of a considerable research into a comparison between descaling and pickling, and points out some interesting and important facts which should be brought to the attention of all who are concerned with this problem. While American wire manufacturers are not yet inclined to seek a solution of their pickling waste disposal by this means, they should manifestly keep abreast of the progress made in this direction in Germany, against the day when their engineers are perhaps impelled by economic and legal considerations to tackle this solution of the difficulty. They will find much of value in the results of the research here reported.

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The mechanical bending-descaling of wire rod is today on another basis than formerly. It is no longer just another special process, but is in its newest development keyed in with the drawing process as a unified operation.

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It is an investigation of results of such an operation and comparison with the results of pickled wire drawing that was undertaken by the Felten and Guilleaume Carlswerk Iron and Steel Firm which is here reported.

Physical Prerequisites for the Removal of Scale

Scale is brittle and not workable, while the base metal, steel, is elastic and very workable. If the steel surface covered with scale is therefore stretched, the scale must finally be broken off and eliminated. In order to determine what degree of extension is necessary for that result, test specimens of wire rod were stretched in a testing machine under increasing tensile stress. It was shown that after reaching an elongation of 3 to 5% the layer of scale began to tear and automatically a peeling off of scale took place. After increasing the elongation to 8 or 9% the greatest part of the scale had fallen off, although scale dust still adhered to the surface. This could be removed by shaking or rubbing. Only by an elongation of 12% was the steel surface automatically completely freed from scale. These three degrees of extension can then be said to characterize (1) beginning of descaling, (2) rough descaling and (3) fine descaling.

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This information can be used in determining the diameter of the bending rolls of the descaling apparatus. By bending the rod about a roll the outer rim gets the greatest elongation and the inner rim a corresponding compression, while between these a neutral zone remains. If the rod is then led over a following roll set with its plane at 90° with the preceding roll, then the previous neutral zone will be the most stretched or compressed, and the previous most stretched or compressed portion will be the new neutral zone. Between the roll diameter and the greatest elongation of the rim of the rod the following relation can be expressed:

$$\frac{(x+2d)-(x+d)}{(x+d)} \times 100 = \text{Elongation in \%,}$$

where x = diameter of the bending roll, and d = diameter of the wire.

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For example: For a No. 5 gauge rod a diameter of 5.2 inches is required for a 4% elongation, 2½ inches for an 8% elongation, and a bit over 1½ inches for a 12% elongation. For a No. 12 gauge wire these diameters become about one-half as great.

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The machines just now on the German market have roll diameters of about 2⅛ inches. These are effective only for the rough descaling of the most commonly used No. 5 gauge wire rod, and further measures have to be taken such as brushing, rubbing with steel wool, blasting, magnetic effect or other means. To select a smaller diameter of roll for this size of common rod is prohibitive, since an elongation going over 8% can lead to rupture with the ordinary quality of metal, and structural difficulties also appear.

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On similar grounds the mechanical descaling of finer wire with decreased diameters of rolls becomes more difficult, so that there is a limit to the use of this process. For larger diameters (than 0.21 inch) there is however no essential limit, as the corresponding increase in roll diameter presents no difficulty.

Comparison of Weight Losses

It is pertinent to compare the losses in metal resulting from pickling and mechanical descaling. An experiment was carried out in which 50 tons of rod in two-ton lots were cleaned by each method. Losses by mechanical bending-descaling varied from 6.1 to 12.01 kg. per ton with 8.7 kg. per ton the mean value. Chemical pickling losses varied from 9.4 to 16.3 kg. per ton with 12.4 kg./t. as the mean. The considerable variations are thought to be due to the previous variations in rolling temperature which was between 750° and 900°C.

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This greater loss by pickling can be explained by the fact that some large portions of the rod surface are more quickly cleared of scale than other portions, which require a longer time in the bath, and this additional pickling permits acid reaction against the already cleaned surface, removing some surface metal. This cannot be prevented by the addition of an inhibitor, though the loss of metal can thereby be somewhat lessened. This economical advantage of the mechanical process covers the installation cost. Moreover the scale recovered is salable.

Comparison of Surface

As might be expected, the surfaces left by the two processes show differences. The surface resulting from mechanical bending-descaling resembles the appearance of the contact plane between the metal and the scale and, as a result of the nature of the process, is full of fissures. The acid of pickling, on the other hand, tends to smooth out the surface. This is shown by the macroscopic views in Figures 1, 2 and 3 representing pickled surfaces, contrasting with Figure 4 showing a surface mechanically descaled.

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The difference is even more clearly shown through interference figure. Fig. 5 shows the interference figure of a pickled surface, while the mechanically descaled surface is shown in Fig. 6. Rod

Figure 1. Pickled steel wire rod with low carbon content (0.08%C). Rolled condition with elongated acid-eaten caries.

Figure 2. Pickled steel wire rod with low carbon content (0.08%C). Rolled condition with pitting.

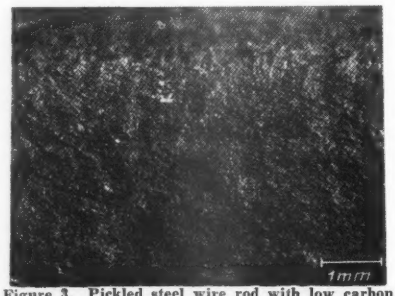

Figure 3. Pickled steel wire rod with low carbon content (0.08%C). Rolled condition with fissures opened by acid attack running in the direction of rolling.

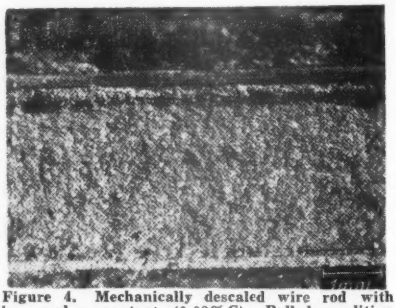

Figure 4. Mechanically descaled wire rod with low carbon content (0.08%C). Rolled condition with localized grooves resulting from damage of the surface by descaler rollers.

that had been pickled shows in Fig. 7 intermeshing elongated bands of grooves formed by the stretching of the separate depressions. Fig. 8, representing the surface of mechanically descaled rod, shows in contrast a much more dense arrangement of essentially shorter grooves, indicating a more even surface roughness of the de-

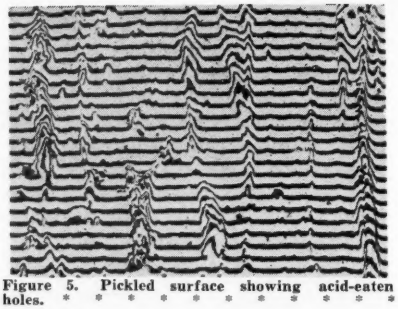

Figure 5. Pickled surface showing acid-eaten holes.

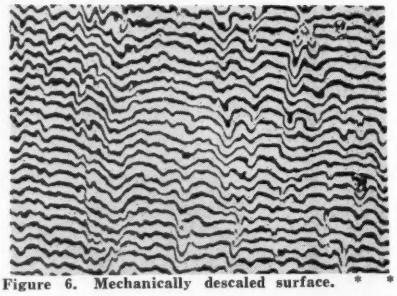

Figure 6. Mechanically descaled surface.

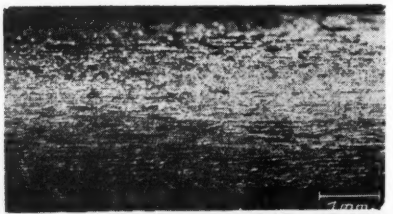

Figure 7. Pickled wire rod (0.08%C) with intermeshing elongated groove bands.

Figure 8. Mechanically descaled wire rod (0.08%C) with densely occurring shorter grooves.

scaled rod.

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These tests show a better surface condition of the mechanically descaled wire as compared with the pickled wire.

Lubricant

The surface of the rod subjected to the two processes may be represented as in Figure 9, where the surface of mechanically descaled rod is shown above and that of the pickled rod below. The rod,

covered with a layer of scale, is shown at the left. The pickled rod has a not completely smooth but an evened-off surface, broken by pittings and laminated depressions. These are commonly covered after pickling by a film of lubricant carrier which is generally composed of a sull coat and covering coat of lime. By running through a powdered lubricant (ground sodium soap), this will be drawn along into the die, there to be subjected to pressure and heat, with a consequent liquefaction of the soap and impregnation of the carrier with the lubricant. This interaction of a light or liquefying lubricant under constant temperature and pressure with the carrier is desired in order to produce a separation film between the metal and the die and ensure anti-friction properties. For this purpose oils and pastes are also usable.

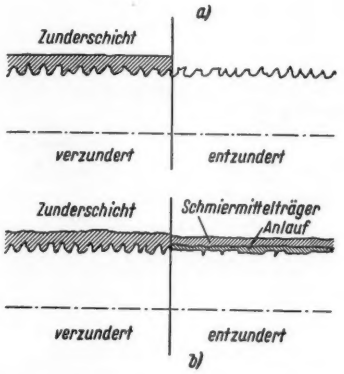

Figure 9. Representation of a (a) mechanically descaled and (b) a pickled wire

Note:
Zunderschicht=layer of scale
verzundert=covered with scale
entzundert=descaled
Schiermitteltrager=lubricant carrier
anlauf=sull coat

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The mechanically descaled rod, on the other hand, has a strongly fissured surface with projecting points. This must be covered by a layer of lubricant without the application of a lubricant carrier, so that the lubricant must serve the purpose of the latter also. The lubricant cannot be easily fusible, but, under persistence of pressure and high temperature, be characterized by its property of forming a specially strong separation film with exceedingly good anti-friction action. These properties are recognized in the metallic soaps or stearates. Such stearates are widely offered by the market. Their application however leads to very widely scattering results, with only a few of them satisfactory.

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In order to discover the effectiveness of the lubricant, the tested varieties of stearate were subjected to compression test. Specimens were inserted between parallel plane plates and subjected to a measured pressure. The lubricant remaining between the plates was then weighed. This experiment showed that the weight of residual lubricant increased with increasing lime content and decrease of fat. The experiment is shown by the graphs in Figure 10.

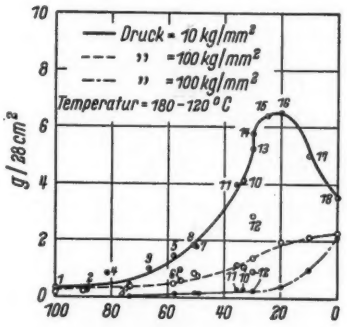

Figure 10. Test of resistance to pressure of various samples of stearates under pressure of 10 and 100 kg/mm² as well as 100 kg/mm² with temperature between 180° and 100°C. Ordinates give residual weight in grams left on 28 sq. cm. surface.

Note: Points are numbered from 1 to 8. Do not take the 1 for 7.

Druck=Pressure. * * * * * * * *

The line representing a pressure of 10 grams per square millimeter reaches a maximum value when the stearate has a fat content of about 20% and with lime content correspondingly about 80%. Then the value falls off with greater content of lime. This shows that with unusually high lime content the compression of the stearate, because of inability of the grains to slide over each other, no longer gives a complete filling of the space between rod and die.

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After the increase of pressure to 100 kg/mm², this fall-off in residue of lubricant with increasing lime content disappears. Evidently with this pressure the space is completely filled in every case. If temperature is at the same time increased the high point of the lime will be lowered still further. Stearates with 70% or more fat content gave in these experiments no measurable residue, and consequently cannot be considered suitable for a separation film. The specimens shown by points 10, 11 and 12 gave satisfactory drawing results. Point No. 1 represents a lubricant of clear fat; No. 2, sodium soap, as they are used for the drawing of pickled rod with a carrier coating. The findings of these experiments show that not only is the resistance to pressure a measure of quality for the lubricant, but that

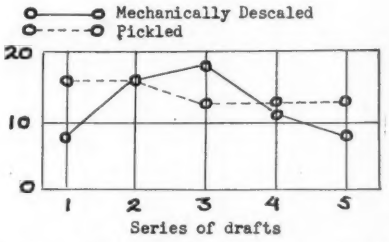

Figure 11. Wear of die by drawing of mechanically descaled and pickled wire rod. Ordinates show tons drawn per wear of 1/100 mm.

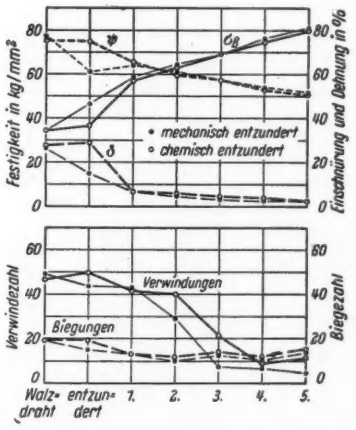

Figure 12. Technological properties of mechanically descaled and pickled wire rod. Tensile strength $\sigma\beta$ contraction ψ, and elongation δ in upper graph. Torsional and bending resistance in lower graph.

Note:
Festigkeit=tensile strength.
Einschnurung und Dehnung=contraction and elongation.
Verwindezahl=number of turns.
Biegezahl=number of bends.
Mechanisch entzundert=Mechanically descaled.
Chemisch entzundert=pickled.
Verwindungen=Torsion.
Biegungen=Bending. * * * * * * * *

at the same time it must have adequate anti-friction properties.

Back-pull in Mechanical Bending-Descaling

The rod is put in tension by the descaling rollers and this acts as a back-pull upon the rod entering the first die of the drawing machine. On the one hand this may be considered an advantage in that transverse forces in the die are lessened, the formation of a film of lubricant is facilitated, and the friction and heating lessened. On the other hand the back-pull may induce a too severe strain in the rod.

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In order to explore this, the back-pull was measured in the case of a mechanical bending-descaler and a No. 5 gauge wire rod of commercial basic Bessemer steel. The arrangement of the descaler was such as to permit varying the angle of grip between the rod and the rollers. The angle itself could not be measured. With an adjustment of the rollers which ensured a satisfactory descaling the back-pull measured 440 lbs. with the slight variation of about 20 lbs. plus or minus. This value proved to be independent of the velocity of the rod. With a tighter setting of the rolls and consequent greater angle of grip, the back-pull increased to 640 lbs. In order to determine the relation between the back-pull and the stress in the rod, the die force with and without back-pull was measured.

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It was found that for a reduction of diameter of 13% the 440 lb. back-pull added nearly 300 lbs. of tensile force to that in the rod without back-pull, this addition lessening slightly as the reduction increased to 33%, but the combined stress in terms of ratio to the breaking stress increased from 32% for the rod without the back-pull to 44% with it in the case of the 13% reduction, and from 55½% to 69% in the case of 33% reduction. With a tighter adjustment of the descaler rolls and a back-pull increased to 530 lbs., these percentages increased to 47½ and 73 respectively. The increase in strain on the rod due to back-pull is clearly evidenced, and in the case of the 33% reduction it was approaching the elastic limit.

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If now stress points occur due to variations in the rod diameter or interruptions in the take-up, the stress can increase to the rupture point. On this account a smaller reduction should be made on the first draft following the descaling. This may make necessary one additional draft for the descaled wire as compared with the drawing of pickled wire.

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The satisfactory operation of the mechanical bending-descaler is however bound up with the existence of back-pull, since this facilitates the formation of a lubricant film. An experiment with a descaled wire drawn without back-pull showed that it got but poor lubrication. As a consequence fewer drafts were possible and the wire moreover exhibited drawing grooves.

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For a further test, lubricants found to be appropriate and indicated by points 10, 11 and 12 on the lowest line in Fig. 10 were used. Results were obtained either in lengths of drawn wire or in tons drawn per 1/100 mm. of wear in the die. Wire rod of No. 5 gauge of commercial basic Bessemer steel was drawn by five drafts on a continuous frame, with an end velocity of 16.4 ft./sec. and an entering velocity of 4.6 ft./sec.

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The first reduction was from 0.216 in. to 0.19 in., the second to 0.16 in., the third to 0.135 in., the fourth to 0.114 in. and the fifth to 0.096 in. The entry angle of the first die was 17°, that of the others 14°, 13°, 12°, 12°. The length of the drawing neck of the die was about one-fifth of its diameter. Fig. 11 shows the results of this drawing in terms of tons of wire drawn per a wear of 1/100 mm. on each die, a total of 50 tons being drawn. The result is not unfavorable to the mechanically descaled wire, although the third die shows somewhat more wear than was produced by the pickled wire and the fifth die had to be changed during the run with the mechanically descaled wire. The wear of the dies was more uniform with the pickled wire. Further tests with larger tonnages gave mean values of die wear at 10.2 and 11.2 tons per 1/100 mm. of die opening which is not significantly different from the result shown in Fig. 11.

How Does the Mechanical Bending-Descaling Affect the Properties of the Drawn Wire?

It is certain that the considerable straining of the metal by the descaling process must have an effect upon the technological properties of the drawn wire. To inquire into this, tests were made of tensile s t r e n g t h , contraction, breaking point elongation, bending and torsional resistance. Figures 12 to 14a show the results with wire

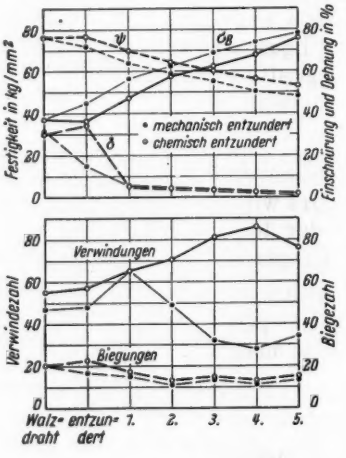

Figure 13a. Technological properties of descaled and pickled wire rod after pot annealing at 700°C.

Note:
Walzdraht=wire rod.
Entzundert=descaled. * * * * * *

of low carbon basic converter steel (0.08% C) and Figures 14b and 15 with wire of open-hearth wire-rope s t e e l with 0.3 and 0.7% C.

Tensile Strength

As expected, the working of the wire rod by the descaler was shown to produce an increase in

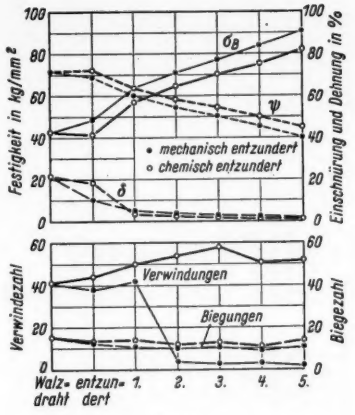

Figure 13b. Technological properties of descaled and pickled wire rod normalized by 900°C. * * *

tensile strength at the outset, but this is matched by the pickled wire after the first draft. Similarly, the elongation and contraction are reduced by the descaling at the outset, but these values become

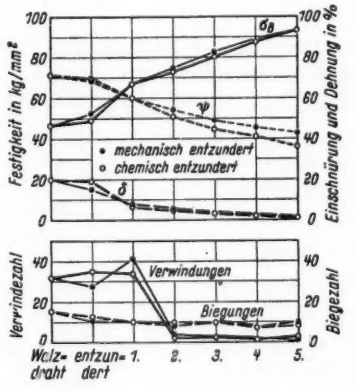

Figure 14a. Technological properties of descaled and pickled wire rod with fresh rolls on the descaler after normalizing by 900°C. * * *

about the same as for the pickled wire after the first draft. Thus descaling is shown to have no appreciable effect on these properties of the drawn wire. The results of the bending test also show no significant difference between the bending resistance of the wire produced by the two processes.

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The torsion test is applied to wire to indicate particularly the uniformity of the material and the surface condition. Fig. 12 shows that the mechanically descaled wire gave definitely lower values than the pickled wire. But these test results are not entirely convincing. Admittedly irregularities

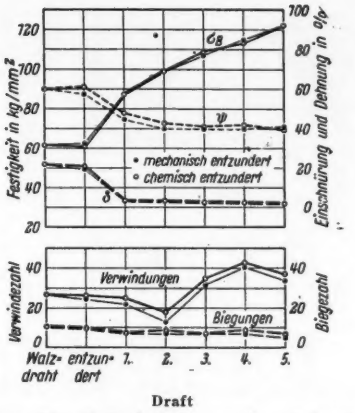

Figure 14b. Technological properties of descaled and pickled wire rod tested on wire rod of wire-rope quality (0.30%C) after normalizing by 900°C. * * * * * * * * * * *

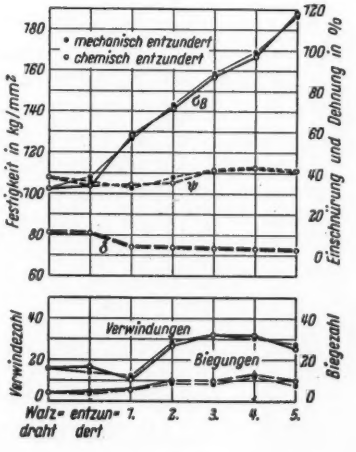

Figure 15. Technological properties of descaled and pickled wire rod tested on rod of wire-rope quality (0.70%C) after normalizing at 900° C. *

in cross-section and also of structural condition of the wire rod will give unsatisfactory results. So further comparative tests were made in which a part of the material was first pot annealed at 700° and part normalized (air patenting) at 900°. Fig. 13 shows that the pickled wire had here good bending qualities while the mechanically descaled wire failed. Its surface showed a quantity of faults which originated from the rollers of the descaler.

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A repetition of the comparison on a descaler with fresh, undamaged rolls led to the result that neither kind of wire was able to pass the bending test (Fig. 14a). A clear reason for this failure in the case of the pickled wire cannot be given. The comparison was pushed further to two kinds of wire rod of wire-rope material with 0.3 and 0.7% C. (Figs. 14b and 15). The wire was first normalized. Both kinds produced the customary pattern of torsional resistance in the sequence of drafts, and in the case of wire with a carbon 0.3% (Fig. 14b) the mechanically descaled wire showed bending values a little under those of the pickled wire. As a result of the bending and torsional tests, therefore, it can be stated that in the majority of cases investigated the mechanically descaled wire proved somewhat or wholly deficient.

Further Processing of Mechanically Descaled Wire

This was not a principal objective of the investigation, so that observations about only a few adaptations can be offered. A part of the mechanically descaled wire was annealed and galvanized in the course of production. So far as the wire was annealed under admittance of atmospheric oxygen in perforated brick ovens, no difficulty was encountered. In annealing in lead baths, particles of lead adhered in considerable amount, which hindered the following pickling and galvanizing process. The galvanized wire displayed black streaks and stains.

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However, the mechanical bending-descaling itself should not be blamed for this, but rather the stipulated use of stearates as lubricant. Stearates create galvanizing difficulties even when they are used in the drawing of pickled wire. Nevertheless there is the possibility that portions of the surface of mechanically descaled wire not sufficiently covered with lubricant are the cause of the adherence of lead.

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Other quantities of the mechanically descaled wire were used for manufacture of wire nails. The nail points were not cut with uniformly good result, as the cutting tools became prematurely dull and

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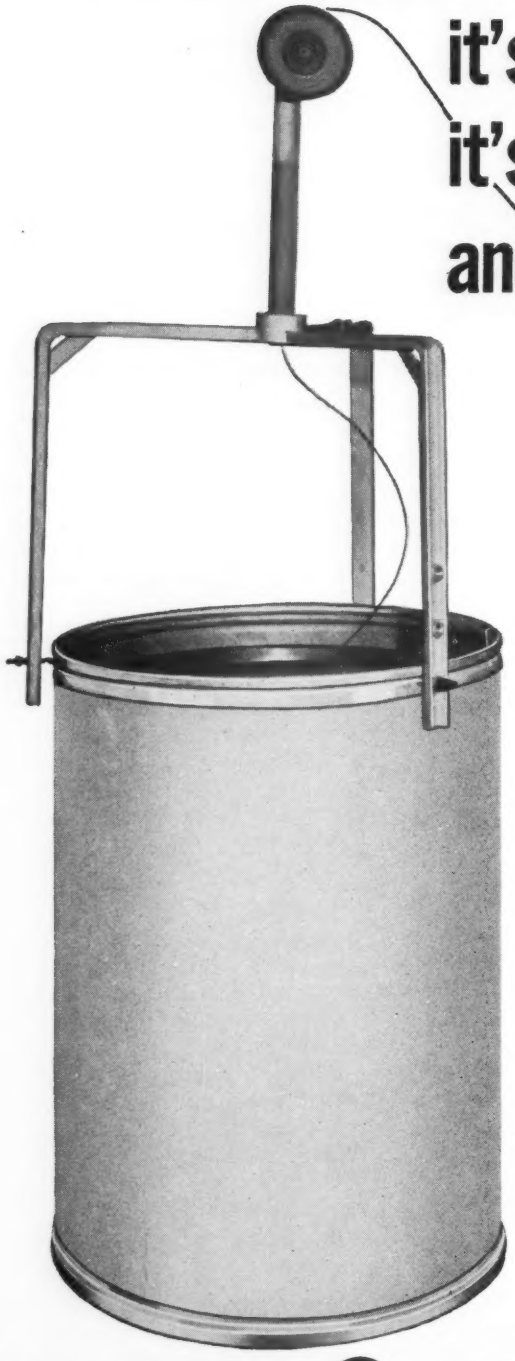

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A User's View of Plastic Insulated Conductors in Outside Telephone Plant

by R. Foulkrod, Chief Engineer
Michigan Bell Telephone Company
Detroit, Michigan

The author presented this paper at the Fourth Annual Wire and Cable Symposium of the Signal Corps on December 7, 1955 at Asbury Park, New Jersey.

Introduction

As a user of plastic insulated conductors, the **Michigan Bell Telephone Company** is seeking a facility which will provide better and more reliable service at less cost. On V-J Day there was a tremendous unfilled demand for telephone service due to the heavily restricted use of critical materials during the war years. This backlog of orders together with the high rate of demand in the postwar period has made an enormous construction program necessary. The magnitude of this program made the search for every possible means of obtaining economy of dollars and manpower essential.

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Plastic insulated conductors were first installed in 1951 in our toll outside plant and in the exchange plant the following year. Subsequently, the use of such insulation was extended to self-supporting, sheathless facilities for use in rural and urban areas. The history and development, from the user's viewpoint, of the various applications is discussed under appropriate headings in this paper.

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Before proceeding, however, we wish to point out that we believe the use of plastic insulated conductors has provided a better and more reliable plant with greater economy.

Toll Cable

In 1950 our Company was faced with the problem of extending a major toll cable route from St. Ignace, on the north side of the Straits of Mackinac, to a toll open wire junction at Trout Lake a distance of 27.5 miles. The schedule for the project called for construction in late 1951 with a service date early in 1952.

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While this territory experiences an average of only 20 to 30 lightning days per year, earth resistivity data indicated that unless special measures were taken a high incidence of lightning troubles could be expected. Based upon this information, consideration was given to burying a lepeth sheat cable (20 KV dielectric core to sheath obtained by providing a polyethylene jacket between the core and lead sheath). Unfortunately in this path there is insufficient soil covering a rocky substructure to make buried construction practicable. Lepeth sheath aerial cable was unavailable at that time for manufacturing reasons. The alternative was a paper insulated cable (2.8 KV core to sheath) with special supplementary lightning protection applied along the entire route. Such construction would be costly and could be expected to provide only mitigative measures rather than preventive measures of the desired magnitude.

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In the summer of 1950 development work at the **Bell Telephone Laboratories** and **Western Electric Company** had progressed to the point where it appeared desirable to make a field trial of a small alpeth sheath cable with the conductors insulated with polyethylene instead of the conventional paper or pulp. Accordingly, 23,000 feet of 26 pair, 19 gauge polyethylene insulated conductor (PIC) cable was installed in the route between Cherry Valley and Cooperstown, New York. It is obvious, therefore, that in early 1951 service experience was almost negligible. However, that which was available coupled with design data and Laboratories investigations indicated that such a cable with a 10 KV core to sheath dielectric offered the best available solution to our problem.

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In addition to reducing lightning troubles, there were a number of other considerations which made the installation of a cable with the characteristics native to plastic insulation desirable for this job. Much of the route between St. Ignace and Trout Lake is inaccessible for long periods of the year except from a motor scooter operated on the tracks of the D.S.S. & A. Railroad. Also the route traverses country which is heavily hunted especially during the deer season. This is of sufficient importance that it is not customary to dispatch a cableman to work in the woods except in a serious emergency. PIC cable was also desirable since this was to be an N carrier route and the attenuation at N carrier frequencies (see table 2) is less for polyethylene insulated pairs than if insulated with paper or pulp.

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With all of the foregoing in mind a decision was reached that this cable offered the best solution to the many problems and the risks were calculated to be less than with any other available facility. Accordingly, a 51 pair 19 gauge cable with alpeth sheath was ordered for delivery and installation in the late summer of

1951. Splicing was completed in the fall prior to the onset of deer hunting.

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The cable was manufactured with each pair color coded black and natural with a natural-natural tracer pair. The dielectric strength was tested at 10 KV wire to wire and core to sheath. A mutual capacitance of approximately .085 mf per mile at 1000 cycles was selected on the basis that it would be less expensive than .066 mf manufacture of which had not been undertaken at that time. Furthermore, studies showed that the same number of repeaters would be required with either facility. In retrospect it is of interest too that this route was of a pattern similar to subsequent jobs in that loaded voice frequency pairs were also involved. Furthermore, at that time we established the precedent which we still follow viz. on PIC cable high cost continuous gas pressure systems cannot be justified.

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In the spring of 1952 we accepted an invitation of the **Bell Telephone Laboratories** to make a field trial of a cable to be provided with expanded polyethylene insulation. The cable was placed in the Grandville-Zeeland portion of the Grand Rapids-Holland toll route in southwestern Michigan, a distance of 19 miles. It is 51 pairs of 19 gauge but .066 mf capacitance was specified in order to eliminate one repeater point. While it was still possible to retain the 10 KV dielectric core to sheath, a lower dielectric of 3 KV between wires resulted from the use of non-solid polyethylene. In view of the fact that there was no distribution from this cable it appeared unlikely that significant differences of potential between pairs would be created and hence there was little reluctance to accept the 3 KV value. On the other hand, this route is also characterized by high earth resistivity (mostly sand) and consequently the high dielectric core to sheath was very welcome in our plant.

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With the completion of this second job, experience was obviously extremely meager. It seemed desirable nonetheless to take stock of the situation and decide what our future course should be. Carrier performance was highly satisfactory and the cables were trouble free. We also had an opportunity to observe the freedom from moisture trouble which may accompany sheath faults. During the hunting season the previous fall and soon after the St. Ignace-Trout Lake cable was spliced, a continuity test revealed cable pair trouble which appeared to be of the type caused by gunshot. In the case of paper or pulp insulated cable the attendant sheath break would require immediate attention to preclude the entrance of moisture and a more extensive repair job, perhaps even the replacement of a section of cable. However, since this was PIC cable and since it was not in service and in view of the reluctance to send workmen to the field it was decided to defer undertaking the repairs thus gaining experience with the moisture resistance of the polyethylene insulation. We thought it significant that when the repairs were made only mechanical damage inflicted by the bullet required attention. It was, therefore, not too difficult to conclude that we should make every effort to build up major toll routes with PIC cable whenever it was available. The following is a brief summary of other toll jobs completed, in progress, or to be undertaken in 1956:

Lansing-Howell, 1952:
76 pairs, 19 gauge,
.066 mf Cap. — 35 miles

Flint-Lapeer, 1953:
101 pairs, 19 gauge,
.066 mf Cap. — 17 miles
76 pairs, 19 gauge,
.066 mf Cap. — 3 miles

Jackson-Hillsdale, 1953:
101 pairs, 19 gauge,
.066 mf Cap. — 20 miles

TABLE 1 - TOLL CABLE

POLYETHYLENE INSULATED CONDUCTORS

In Service

	Dwg.	Cap.	Size	Ga.	Miles A-UG	Miles Buried	Place Date	Remarks
St. Ignace-Trout Lake #51139	1580	.085	51	19	27.5		Sept. 1951	
Grandville-Zeeland #51310	1621	.066	51	19	18.9		May 1952	Expanded Polyethylene
Howell-Lansing	1635	.066	76	19	34.8		Summer 1952	
Flint-Lapeer #52276	1711	.066	101	19	17.0		Jan.-	
	1711	.066	76	19	3.1		Feb. 1953	
Jackson-Hillsdale #53074	1727	.066	101	19	19.8			
	1727	.066	51	19	14.4		July 1953	First System Standard Cable Production
Saginaw-Bad Axe #54079	1741	.083	76	19	15.9	9.4	Fall 1954	
			51	19	40.4	6.2	" "	
			31	19	0.6		" "	
			26	19	1.7		" "	
		Total			194.1	15.6		

Under Construction

Menominee-Marquette #55184	1814	.083	101	19	18.3	1.0	Sept. 1955	
Niles-Buchanan	1814	.083	101	19	5.9		Late 1955	Niles to Buchanan
South Bend #55454	1814	.083	51	19	9.7			Buchanan to Galien
		Total			33.9	1.0		

Proposed Construction

Niles-Edwardsburg #55524	1814	.083	51	19	1.4	1.3	Early 1956	To be extended 9.4 Miles
	1814	.083	31	19	1.9		" "	By Gen.Tel.Co. of Mich.
Menominee-Marquette	1814	.083	76	19	6.7		1956	Extension to Gwinn of Cable placed 1955
		Total			10.0	1.3		

51 pairs, 19 gauge,
.066 mf Cap. — 14 miles

Saginaw-Bad Axe, 1954:
76 pairs, 19 gauge,
.083 mf Cap. — 25 miles
51 pairs, 19 gauge,
.083 mf Cap. — 47 miles
31 pairs, 19 gauge,
.083 mf Cap. —0.6 miles
26 pairs, 19 gauge,
.083 mf Cap. — 2 miles

Menominee-Marquette, 1955:
101 pairs, 19 gauge,
.083 mf Cap. — 19 miles

Niles-Buchanan, 1955:
101 pairs, 19 gauge,
.083 mf Cap. — 6 miles
51 pairs, 19 gauge,
.083 mf Cap. — 10 miles

Niles-Edwardsburg, 1956:
51 pairs, 19 gauge,
.083 mf Cap. — 3 miles
31 pairs, 19 gauge,
.083 mf Cap. — 2 miles
This route will be extended with PIC cable a distance of 9.4 miles by the General Telephone Company of Michigan.

Menominee-Marquette, 1956:
76 pairs, 19 gauge,
.083 mf Cap. — 7 miles

★ ★ ★

Most of the above installations employ standard aerial cable construction along existing pole lines. Occasionally, where no pole line was in place the cable is buried.

TABLE 2 - TROUBLE REPORTS

P.I.C. TOLL CABLE

To 8-1-55

Route	Installed	Troubles	Nature of Trouble
St. Ignace-Trout Lake	1951	12	Damaged by Gunshot
		2	Damaged by Pole Fires
		1	Wet at Defective Splice Closure
Grandville-Zeeland	1952	2	Damaged by Gunshot
Howell-Lansing	1952	1	Splicer's Error
		1	Open Pair-Cause Unknown
		1	Damaged by Motor Vehicle Fire
Flint-Lapeer	1953	1	Damaged by Gunshot
Jackson-Hillsdale	1953	1	Damaged by Gunshot
		1	Damaged by Motor Vehicle Fire
		1	Sheath Damaged by Swamp Grass Fire
Saginaw-Bad Axe	1954	1	Damaged by Gunshot
		1	Wet Load Coils
	Total	26	

Summary:		Cases	Percent
	Damaged by Gunshot	17	65
	Damaged by Fire	5	19
	Moisture	2	8
	Splicer's Error	1	4
	Cause Unknown	1	4
	Total	26	100.0

Trouble Frequency 5.8 troubles per 100 sheath miles per year.

TROUBLE FREQUENCY - 1954

All Toll Cable

Troubles per 100 Sheath Miles

Aerial	52.
Underground	9.5
Buried	6.4

ATTENUATION db per Mile

CONDUCTORS

Frequency KC	19 Gauge Paper Insulation .066 mf	.085 mf	Quadded Cable	Poly Ins. .066	.083	22 Gauge Paper Ins. .083	Poly Ins. .083
1	1.11	1.26	1.08	1.11	1.25	1.8	1.8
48	3.84	4.8				7.8	7.4
96						9.4	9.0
136	5.89	7.4				10.7	10.4
150	6.40	7.8	6.03	5.35	7.0		
168	6.51	8.2				11.7	11.2
208						12.8	12.4
250	8.45	10.2	8.0	6.89	9.1		
256	8.13					14.1	13.7

On the Saginaw-Bad Axe job, however, it is noteworthy to mention that about 16 miles out of a total of nearly 75 miles was plowed in with a WC-24 plow. Nearly all of the exchanges to be served by the new cable could be reached by alternate routes. This was not true, however, of the Pt. Austin exchange in the extreme north of the Thumb Peninsula. On that basis, a path was selected along a road a mile or so east of the pole line and the cable was buried in lieu of erecting a pole line.

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As may be seen in Table 1, we now have 209.7 miles of PIC toll cable in service with an additional 46.2 miles under construction or projected for 1956. Probably nowhere else in the United States is there an equal amount of plastic insulated conductor cable carrying as important circuits which has been in service for as great a period of time.

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Quite naturally the question arises, how does it perform? The best answer we can offer may be found in Table 2, the Trouble Reports. Discussion of the causes of these troubles is relatively unimportant. However, before proceeding, an outline of a few of the benefits obtained from the use of PIC may be of interest. As pointed out above, the best method to reduce the magnitude of trouble due to sheath faults is a continuous gas pressure system which is costly to install and maintain.

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All cables in the tabulation with one exception were damaged by gunshot (65% of all trouble cases) with trouble magnitude limited by insulation rather than gas. Fires were the cause of another 19% of the troubles. Gas in such cases is of no protection because of total sheath destruction. In each fire case listed, trouble was limited to physical damage. For example, on the Jackson-Hillsdale cable the sheath was destroyed in a pole to pole span by the swamp grass fire but no circuit trouble was experienced. The motor vehicle fire destroyed the sheath and 45

pairs of the Howell-Lansing cable but the more important N carrier systems in the remaining 31 pairs were unaffected. An unlocated sheath fault in the buried portion of the Saginaw-Bad Axe cable admitted the moisture which caused trouble in two load coils on voice frequency circuits. The remaining pairs including high priority leased circuits continued to operate satisfactorily. You will also note the complete absence of troubles caused by lightning. Such experiences as these make the use of polyethylene insulated conductors most attractive and worthwhile.

Exchange Cable

Not long after construction was started on the first toll PIC cable job in 1951, and as a result of discussions with the **Bell Telephone Laboratories,** we decided to undertake a program involving the use of 6 pair, 19 gauge PIC cable. In our state we are confronted with substantial areas which are sparsely settled, but where there is a demand for telephone service. To serve such territories economically, is in general, a job requiring the utmost ingenuity. The availability of a small cable opened many avenues of new thought.

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Accordingly, during 1952 about 100 miles of 6 pair, 19 gauge PIC cable was shipped to us. Some of this cable was simply laid on the ground next to the fence line and trenched in by hand across drives and side roads in rural areas. Some was placed in accordance with standard aerial construction practices. Very early in the program, however, we learned that because of light soil conditions, which are rather commonly found in Michigan, it was possible to plow-in this small cable with a wire plow (the W-16) using a line construction truck as the prime mover.

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The W-16 plow will place wire (or small cable) at a maximum depth of 16 inches, which is considerably more shallow than usually attained for buried cable. Nevertheless, a cover of 12 inches to 16 inches seemed to provide better protection than no cover and we found that in many instances less manhours were required to plow the cable in the road shoulder than to place it on the ground along the fence line.

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A line construction truck, of course, is not designed to act as a prime mover. We must, therefore, not overlook the fact that extra maintenance and repairs on these trucks has been about $3.50 per mile of buried cable plant. Such an expense is quite small when compared to the charges made by contractors furnishing track type power units. That we realized our objective is evidenced by data which show that the in-place cost of this item is about 65% of the cost of a pole line and 6 pairs of open wire. Since the onset of this work, we have placed approximately 250 miles of such cable as described. Trouble frequency, so far, is unbelievably low, in fact, during 1954 no troubles were reported in buried exchange PIC cable. In connection with this type of construction, we began a search for an inexpensive cable terminal to distribute a pair or pairs to customers along the route. Bell System standard terminals at that time had, of course, been designed on the basis that the cable core was not moisture-proof and, therefore, an appropriate terminal block assembly and cable closure were mandatory.

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However, in view of the moisture-proof characteristics of PIC we decided that entirely new concepts might be employed. We, therefore, developed from readily available piece parts a 6 pair terminal, using a 10 pair terminal housing, a 6 pair connecting block mounted inside, and arranged so that the cable might enter one or both ends. The cable was terminated "in" and "out" on the connecting block. Sheath continuity was obtained by cutting the aluminum so that tabs were turned back over the sheath of the entering cable which was then clamped to the metal terminal housing. As can be noted, no effort was made to protect the core or terminations from atmospheric humidity. Experience with this terminal showed that at reel ends it was less costly to terminate "in" and "out" than to make a splice. Thus a further economy was introduced.

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During 1955 we have undertaken an extension of the program of placing buried PIC cable for customer distribution, in that cables up to and including 51 pairs are being placed (see table below). Bell System standard arrangements have been made to supply terminals for the larger cable sizes employing the same basic principles as were incorporated in our earliest model. We expect to continue the expansion of the program and to this end we have purchased a small self-propelled trencher which will open a narrow slot 2¼ inches or 4½ inches depending upon the bucket chain used. With this machine we expect it may be practicable to furnish a completely underground telephone system in new housing developments. We believe it may be possible that such an installation can be made at a cost less than one employing the present conventional overhead construction methods.

BURIED PIC EXCHANGE CABLE

1955 Program

6 Pair	122 Miles
11 "	54 "
16 "	42 "
26 "	15 "
31 "	5 "
51 "	20 "
Larger	12 "
	270 Miles

EXCHANGE PIC CABLE
Total in Plant
(All Sizes)
Rural Wire

In 1951 prior to the availability of 6 pair PIC cable the Michigan Company undertook to develop a

small, multiple pair, sheathless, self-supporting facility which would provide lower cost telephone plant. After much discussion of the possible forms it was agreed that several pairs of wire insulated with polyethylene and cabled around an extra high strength steel wire of .109" diameter (breaking strength 1,800#) might be practicable. We took this concept to the American Telephone and Telegraph Company and the Bell Telephone Laboratories and arrangements were made to produce 10,000 feet for field trial of a 5 pair, 19 gauge polyethylene insulated facility. The trial was augmented by the production of 10,000 feet of a 5 pair, 20 gauge facility with each wire rubber insulated and neoprene jacketed. These items were installed in January, 1952.

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Based upon observations made at that time, it was decided to abandon further consideration of the 20 gauge item. Its outside diameter was greater making it more vulnerable to ice and wind loading and its electrical characteristics were inferior to 19 gauge polyethylene insulated conductors. Unfortunately, however, this early experience showed that the polyethylene insulation was below a desirable value in resistance to abrasion. In an effort to improve the situation a number of materials were considered before it was finally decided to jacket the polyethylene with PVC (Polyvinylchloride). Originally the PVC was black but early in 1955 it was pigmented to provide a full color code.

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The Michigan Company placed approximately 150 miles of the 5 pair item following the field trial and prior to the middle of 1953. At that time it was changed to a 6 pair facility and standardized for Bell System use. Since then, we have placed more than 1,800 miles of Rural Wire.

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Data on placing this wire show that its cost in place on an existing pole line is about 60% of that for placing 6 circuits of open wire. Additional savings may be realized due to the fact that Rural Wire requires less pole space on an existing open wire line, thus obviating in many instances high cost pole replacements in order to gain added pole height. This can be seen from the fact that crossarms are, in general, spaced 2 feet apart whereas Rural Wire may be installed between arms, at the level of a crossarm, or even from the underside of an arm.

★ ★ ★

We recognize that the physical life of the facility is not yet established and the rate of increase in troubles as it ages is not known. Up to now, however, the trouble performance of Rural Wire compares very favorably with other standard facilities as may be seen in the table below:

B RURAL WIRE

Mileage in Plant	12-31-52	70
	12-31-53	250
	12-31-54	940
Mileage Added First Half 1955		500
Mileage to be Added Second Half 1955		750

1954 TROUBLE RATES

B Rural Wire:	
Per 100 Facility Miles	16.7
Per 100 Conductor Miles	1.4
Aerial Exchange Cable:	
Per 100 Sheath Miles	103.0
Toll Open Wire:	
Per 100 Conductor Miles	4.4
Exchange Open Wire:	
Per 100 Conductor Miles	19.9

The popularity of this facility has tremendously exceeded the expectations of any of us who participated in the development. In addition to the **Western Electric Company,** there are probably more than a half dozen manufacturers engaged in the production of similar items for use in the independent telephone industry.

Urban Wire

Our successful use of the 6 pair Rural Wire facility and the benefits derived therefrom, led to the conclusion in early 1953 that perhaps a modification of the rural design would permit the addition of pairs and thus provide a facility suitable for urban distribution. It may be of some interest to set forth here the ground rules for the development. First, the facility should retain all of the handling characteristics of Rural Wire; second, it should be of as many pairs as possible; and third, it should be a fully color coded item.

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The initial effort took the form of 30 pairs of 24 gauge wire insulated with PVC (no polyethylene) and cabled around a quarter inch strand. Work with this facility at the field laboratory showed at once that it did not comply with the established parameters. First, it was too heavy and too difficult to handle with a 2-man line construction crew. Second, it lacked the ease of access to any pair which is required by station installers and repairmen. Both of these were paramount requirements in order to realize the economies being sought.

★ ★ ★

A 20 pair facility was then given consideration but again investigation showed it to be beyond the limits of handling by a 2-man crew. However, 16 pairs of 24 gauge PVC insulated conductors provided an item of approximately the same outside diameter and weight as Rural Wire and with the required handling characteristics for all of the various craft people involved. In November 1954, 200,000 feet of 16 pair Urban Wire was put on field trial in the Bell System. Half of this was allocated to Michigan with five other operating areas in the west, south and east being allocated 20,000 feet each. In our own experience with this wire we realized the economies which were anticipated and this, coupled with favorable comments from the other companies, led to Bell System standardization of the item for installation beginning in the fourth quarter of 1955. We anticipate that the cost of Urban Wire in place will be of the order of 55% of that of a comparable standard cable installation.

(*Please turn to page* 470)

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General Properties of The New Super-Polyethylenes

by George H. Sollenberger
Koppers Company, Inc.
Pittsburgh, Pennsylvania

This paper presented by the author at the Signal Corps' Fourth Annual Wire and Cable Symposium at Asbury Park, N. J., on December 8, 1955, is published here with his permission and through the courtesy of his company.

Introduction

Your Symposium Committee has asked me to talk to you about the new super-polyethylenes. The Committee believes, and I heartily concur, that the electrical industry cannot take full advantage of these new materials unless the processors are completely familiar with the unusual properties as well as with the limitations of the super-polyethylenes.

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The basic discussion will cover the materials from the standpoint of practical applications and the more standard plastics test procedures. For simplicity, comparisons will be made with plastic materials with which you are already familiar. Some of you may prefer your own specialized tests. These can be discussed later and, if answers should not be readily available, arrangements can be made to run the tests or to send you material for your own experimentation.

Heat Resistance

Some of you may have seen our pressure cooker demonstration, in which comparable parts of conventional and super-polyethylene were subjected to 250°F. In this test, the conventional polyethylene part completely loses its shape, while the article molded of super-polyethylene retains its shape and surface finish, showing about 2-4% dimensional reduction. Exposure for a much longer period at 212°F. will generally show the same 2-4% change. This is fine for items in which dimensions are not critical, since the repetitive heating does not show further change, but allowance must be made for this change if assemblies or parts thereof are to be subjected to high temperatures. It must also be recognized that 250°F. is approaching the "no strength" temperature. At this temperature, pieces will hold their shape but cannot be expected to possess much mechanical strength.

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This heat resistance should be of value in bottles and in film where it may be desirable to sterilize the contents in the package. In the case of insulated wire, the conductor should be less likely to cut through the insulation. Pipe will have a greatly broadened service range and may permit sterilization with exhaust steam.

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You are aware that the heat resistance of conventional polyethylene can be improved somewhat by atomic bombardment or irradiation of each individual molded piece. However, the hazards, limitations, and expense of such a process can be eliminated by taking advantage of the built-in heat resistance of the super-polyethylenes.

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Incidentally, preliminary work indicates that "Super Dylan" polyethylene also responds to irradiation, and that a comparable improvement of properties can be obtained, with about 25% the megarep input required for ordinary polyethylene.

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Wire coated with "Super Dylan" polyethylene has been exposed for one month at 250°F. in an air oven without cracking. The samples for this test were prepared by looping the wire and then wrapping it back on itself in order to produce a very high outer-fiber stress on the insulation.

Low Temperature Impact

Another excellent example of the broad range of properties embodied in the super-polyethylenes is their toughness at low temperatures. On the Izod Impact Tester, un-notched samples showing over 32 ft. lbs. per inch of face at room temperature still show over 32 ft. lbs. in dry ice—that's -100°F.

★ ★ ★

In the case of notched samples, the dry ice impact strength was over 60% of the room temperature strength. The value of this retention of properties at low temperatures is readily apparent so far as aircraft, military, and refrigeration applications are concerned. This retention of properties is especially valuable in the case of wire insulation. Wire coated with "Super Dylan" polyethylene, thoroughly chilled to -20°F., has been tested by looping the wire and giving the ends a quick jerk to form a sharp kink. The "Super Dylan" polyethylene insulation showed no cracks or splits.

Tensile Strength

The increased tensile strength of the super-polyethylenes can be utilized advantageously for pipe, since the bursting strength of pipe is related to the tensile strength of the material from which it is made. Short-term hydro-static tests on 1" IPS Schedule 40 pipe show a burst strength

for conventional polyethylene of 300-400 psi as opposed to 900-1000 psi for the super-polyethylene type. It has also been found that the strength of the super-polyethylene pipe does not fall off rapidly as the temperature increases. Tests in boiling water show that super-polyethylene pipe has about the same bursting strength at 212°F. that conventional polyethylene pipe displays at room temperature.

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No specific information is available yet on long-term service at various pressures and temperatures, but such tests are under way.

★ ★ ★

Rather surprising tensile strength has been observed in monofilaments of super-polyethylene, with readings as high as 95,000 psi. This figure is considerably above the strength of vinylidene chloride, and equals the strength of nylon monofilaments of the same diameter.

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This same hi-tensile property should be of value in super-polyethylene film if proper orientation can be achieved, preferably biaxially.

Chemical and Solvent Resistance

Since these new hi-modulus materials are ethylene polymers, their chemical resistance is generally comparable to that of conventional polyethylenes with respect to aqueous solutions of acids, alkalis, and salts. Resistance to detergents is **very** good, as is illustrated by the proposed standard test for environmental cracking. Long-term chemical tests are under way.

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Preliminary tests indicate that the super-polyethylenes will be superior to conventional polyethylene with respect to oil resistance.

★ ★ ★

For outdoor applications, carbon black protection is necessary and all wire-coating material should contain an antioxidant. This should be specified, incidentally, in sample requests or orders.

Permeability

In the packaging industry, the diffusion of certain volatile contents through conventional polyethylene bottles and films has been a problem for a long time. Tests indicate that diffusion through the super-polyethylenes is very considerably less than that of the conventional types. This, we believe, will be of real interest to the users of polyethylene bottles and films.

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In some types of cable, vinyl chloride compounds are in contact with or are in close proximity to polyethylene. Based on preliminary findings, the troubles caused by the migration of plasticizers should be greatly reduced by the use of super-polyethylene.

Rigidity

The flexibility of conventional polyethylene, while quite desirable for squeeze bottles and similar applications, can be a serious limitation for many other jobs. For years the plastics industry has wanted a material with the chemical inertness and toughness of polyethylene coupled with semi-rigidity. The super-polyethylenes appear to fill the bill.

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This means, however, that pipe will probably be shipped in 20 foot lengths instead of being coiled. It means basins and bowls which don't distort when filled and containers that hold their shape. It may also mean film which can be pushed through automatic packaging machines like paper or cellophane instead of being pulled through.

★ ★ ★

This higher stiffness modulus may not influence the use of super-polyethylenes in wire coatings, since the stiffness of the conductor will probably be the controlling factor, and since the slight additional stiffness may be more than offset by the other advantages.

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Going further with this matter

SUPER-POLYETHYLENE PROPERTIES CHART

Property	Units	Test Method	Range of Values
Compression Molding Temperature	°F.		300-450
Compression Molding Pressure	psi		1000-3500
Injection Molding Temperature	°F.		300-600
Injection Molding Pressure	psi		8000-20,000
Compression Ratio			2.0
Specific Gravity		ASTM-D792	0.93-0.96
Specific Volume	Cu.in/lb.	ASTM-D792	29.5
Tensile Strength	psi	ASTM-D638-52T	2800-5500
Elongation in Tension	Percent	ASTM-D638-52T	25-400
Modulus of Elasticity in Tension	10^5psi	ASTM-D638-52T	0.25-0.55
Stiffness Modulus	Lbs./Sq. In.	ASTM-D747-50	50,000-140,000
Impact Strength			
Notched Izod	Ft.Lbs./In. of Notch	ASTM-D256-47T	0.5-5.5
Un-notched Izod	Ft.Lbs./In.	@ 21°C (70°F)	Over 32
Un-notched Izod	Ft.Lbs./In.	@-73°C (-100°F.)	Over 32
Hardness (Shore D)		ASTM-D676-49T	63-70
Dielectric Strength, short time	Volts/Mil	ASTM-D149	500-700
Dielectric Strength, step-by-step	Volts/Mil	ASTM-D149	500-700
Dielectric Constant, 60 cycles		ASTM-D150-47T	2.2-2.35
Dielectric Constant, 10^3 cycles		ASTM-D150-47T	2.2-2.35
Dielectric Constant, 10^6 cycles		ASTM-D150-47T	2.2-2.35
Dissipation (power) Factor, 60 cycles		ASTM-D150-47T	0.0005
Dissipation (power) Factor, 10^3 cycles		ASTM-D150-47T	0.0005
Dissipation (power) Factor, 10^6 cycles		ASTM-D150-47T	0.0005
Arc Resistance	Sec.	ASTM-D495	200-235
Burning Rate	In./Min.	ASTM-D635-44	0.9-1.1
Brittleness Temperature	°F.	ASTM-D746-52T	Below -100°F
Deformation Under Load	Percent	(ASTM-D621-51 (50°C.(122°F.) (Method B.	0.05-0.40
Melt Index	Gms./10 Min.	ASTM-D1238-52T	0.1-4.0
Effect of Sunlight			Surface crazing, except black or brown.
Effect of Weak Acids		ASTM-D-543	Very resistant
Effect of Strong Acids		ASTM-D-543	Slow attack by oxidizing acids.
Effect of Weak Alkalis		ASTM-D-543	Very resistant
Effect of Strong Alkalis		ASTM-D-543	Very resistant
Effect of Organic Solvents		ASTM-D-543	Soluble in aromatic and halogenated above 60°C.
Clarity			Translucent to opaque
Color Possibilities			Unlimited

of flexibility it has been found that repeated sharp flexing invariably breaks the conductor **before** the super-polyethylene coating fails.

★ ★ ★

This may be a good time to mention that the higher Durometer hardness of super-polyethylenes should provide greater cut resistance for wire which must be dragged through conduit.

Family of Materials

The polymerization process, with its many modifications is sufficiently flexible that it is possible to produce a variety of polymers which display a wide range of physical properties.

★ ★ ★

Examples are the two materials which Koppers is currently offering. These first two types have been selected as having physical properties which appear to be well adapted to specific applications in the plastics industry. Type 6200, with a melt index of 1.0-3.0 and a tensile strength of 2800-3800 psi, is recommended for general injection molding work, where easy flow and excellent surface appearance is desired. Type 6600, with a melt index of 0.1-1.0 and a tensile strength of 3800-5000 psi, is suggested for jobs which require good mechanical properties but do not demand best appearance. The specifications on these types are at the moment quite broad because we want to determine what the industry prefers. We expect that other types, embodying different properties will be offered as our developments progress.

Surface Quality

For years, the buyer of injection-molded plastic articles has had to be content with the dull, lustreless, waxy surface of articles molded from conventional polyethylene. Now, articles molded from "Super Dylan" polyethylene type 6200 can have a beautiful smooth glossy appearance. If the injection molder should require the higher mechanical strength of type 6600, he must today accept a less-attractive surface finish. This condition, it is hoped, is temporary and it is believed that good surface quality should be possible over the entire range.

★ ★ ★

Water-quenched film and wire have a smooth, brilliant finish and, incidentally, the film is completely non-blocking.

Color Range

While the super-polyethylenes are quite transparent in thin sections, such as packaging film, the natural color in greater thicknesses is a translucent white. Starting with such a material, a wide range of translucent and opaque colors is possible, depending on the thickness and colorant concentration. For outdoor usage, black is recommended.

Processing

In spite of the toughness, rigidity, and heat resistance of the super-polyethylenes, they can be processed in standard equipment with little or no modification of usual practice.

★ ★ ★

There have been no difficulties with "Super Dylan" polyethylene type 6200 in regular or pre-plasticizing injection or transfer equipment. The easier flow and superior surface quality of type 6200 has already been mentioned, and thin-wall tumblers have been molded on one of the new high-speed machines at the rate of eight shots per minute. The tendency to flash is much less than that of ordinary polyethylene, and stripping from the core is far easier.

★ ★ ★

Mold shrinkage appears to be about 0.15-.030 in./in. for optimum molding conditions. This must be kept in mind by the molder who expects to run super-polyethylenes in a mold which was built for another material.

★ ★ ★

Conventional polyethylene parts often show considerable warpage as they cool, and the greater stiffness of the super-polyethylenes makes such warpage more apparent. Some thought must be given, therefore, to mold temperature control, differential mold temperatures, and possibly more extensive cooling fixtures.

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For fabrication, the hot gas and welding rod technique is easy and effective. 75-85% tensile strength has been observed in a fresh weld.

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Wire coating with a cross-head extruder is routine, with up to 50°F. additional heat on the barrel. Pre-heated wire is helpful. Rates have been comparable to those achieved with conventional polyethylene.

★ ★ ★

Film extrusion by the flat die and water tank process parallels the usual procedure. Heat-sealing of film can be accomplished on standard bag-making equipment simply by raising the sealer bar temperature 50-70°F.

★ ★ ★

Pipe extrusion follows the usual systems. An extended mandrel provides accurate internal sizing. An outside sizing tube or vacuum box with a series of sizing die plates provide good O. D. control. The air-ring system often used for cellulosics has proven satisfactory.

★ ★ ★

The tapered sizing die and water tank process commonly used for conventional polyethylene pipe has **not** proven satisfactory.

★ ★ ★

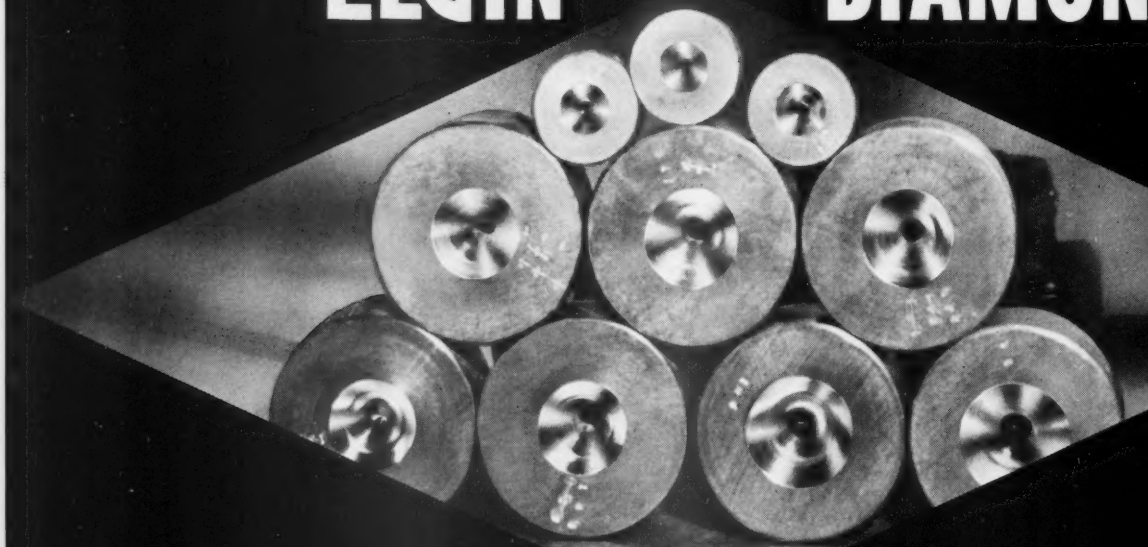
Sheet extrusion follows the hi-impact polystyrene procedures, and hot-roll polishing is effective. Vacuum forming of sheet is made easier by the absence of a sharp freezing point, and the rather flat cooling curve provides ample working time.

Conclusion

Over a period of years the plastics industry has build up a wealth of information and experience on plastics processing and application, it will be necessary for processors to "know" the super-polyethylenes —just as thoroughly as the existing materials are now known.

(*Please turn to page* 476)

ELGIN DIAMOND



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ABRASIVES DIVISION

ELGIN NATIONAL WATCH COMPANY

Dept. G

ELGIN, ILLINOIS

Modern Straightening and Cutting Equipment

by William L. DeSenti, President
and
Arnold J. Tenner, Chief Engineer
Mettler Machine Tool, Inc.
New Haven, Connecticut

A history and the principles of operation of this most useful tool of the wire industry, used in most wire product plants to prepare wire for fabrication into innumerable forms.

Back in 1866, **John Adt** invented and built the first machine ever made in this country for the automatic straightening and cutting of wire. His company, **John Adt & Son,** were succeeded in 1895 by the **F. B. Shuster Co.,** who in turn were succeeded in 1948 by **Mettler Machine Tool, Inc.**

★ ★ ★

Franklin B. Shuster is credited with having done more for the wire straightening industry than any other individual. With his extraordinary mechanical ability he was able to develop Adt's principles into more efficient machines. Shuster devoted much time to designing and building of special machinery and from this developed many machines, some of which today have become standard equipment.

★ ★ ★

This company has taken up where Shuster left off, providing the wire industry, both here and abroad, with efficient, economical and up-to-date wire straightening and cutting equipment.

★ ★ ★

During the 90 years since John Adt made his first machine, continual improvements and developments have been made, so much so that modern machines bear little outward resemblance to early models. The first machines, which were run off countershafts, had capacities of straightening and cutting wire at the rate of 60 feet per minute, have been developed into present day machines which are motor driven and have capacities on certain models in excess of 200 feet per minute.

Principles of Operation

The automatic wire straightening and cutting machine takes the wire from a coil, straightens it through a series of rolls and cuts it to accurate lengths at high speed and low cost. Little attention is required beyond keeping it supplied with coils of wire. See Figure 1.

★ ★ ★

Machines are now designed to have the fewest possible number of moving parts, with thoroughly engineered bearings and materials, so that the consumer may expect year after year of machinery use with very little part replacement and maintenance.

★ ★ ★

The stock is fed through the straightener and out into a covered, grooved guide bar, in which is located an adjustable gauge that may be set to cut any length within the maximum capacity of the machine. When the stock strikes this gauge it throws the cutting mechanism into action, the piece is cut off and at the same time the cover of the guide bar is opened and the piece drops out into the forked holders provided.

★ ★ ★

The grooved guide bar, with its cover, eliminates any possibility of the wire springing and insures accuracy of length, as the wire is supported for its entire length.

★ ★ ★

The above is all accomplished generally as a split-second operation. Many of these machines perform the operation cycle well over 140 times each minute.

Type of Straighteners

There are basically two types of straighteners, these being the rotary arbor and roll straightener. The rotary arbor contains five sets of straightening dies equally spaced at distances dependent upon the size of the wire to be straightened. See Figure 2. This arbor is rotated at various speeds for different size wires. Nearly one hundred years of engineering information has developed a very exact knowledge of the relationships between the distance between

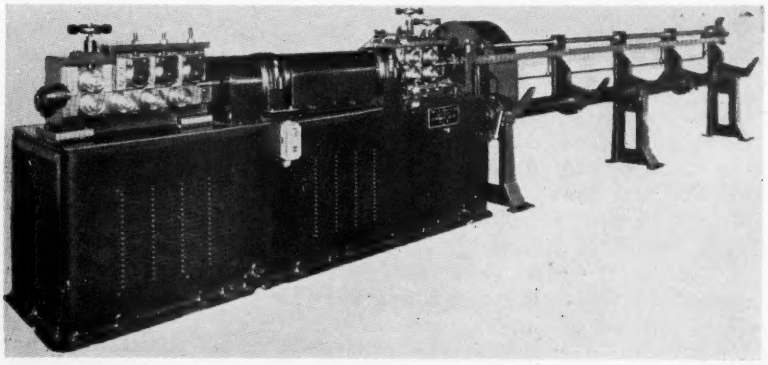

Figure 1. Typical modern straightening and cutting machine for heavy wire (¼" to ½" diam.).

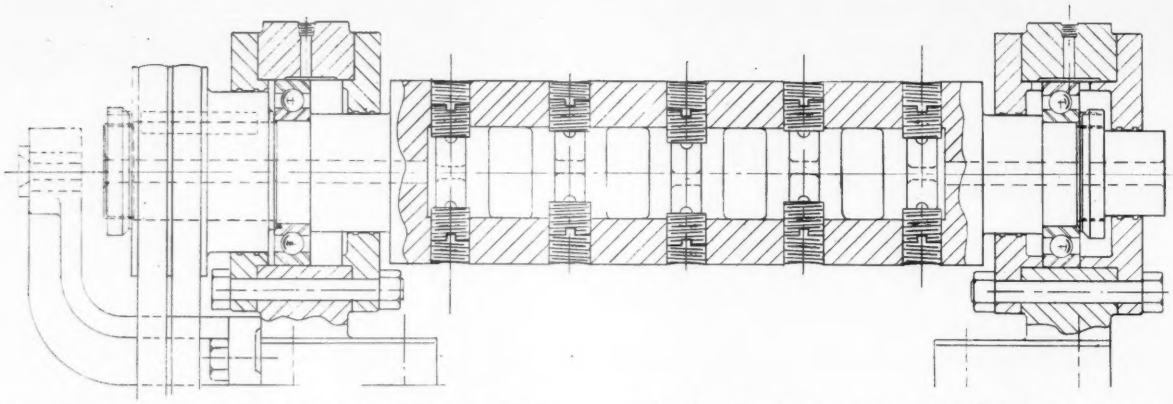

Figure 2. Drawing showing detail rotary arbor straightening mechanism.

arbor dies and the speed of arbor rotation. All this information has been incorporated into the modern-day machines, resulting in considerably greater productivity and reliability.

★ ★ ★

Many different types of arbor dies are used. Some of the materials used are felt, wood plastics, ceramics, bronze, cast iron, hard iron, and carbide. These different types of dies are usually selected to maintain certain types of wire straight. See Figure 3.

★ ★ ★

The development of the roll straightener has increased the versatility of the wire machines. This type of straightener allows for the straightening of wire that is not round. Present machines are so designed that the rotating arbor can be removed and a roll type straightener replaced on the same machine. In a matter of a few hours a machine can be completely reconverted by the user.

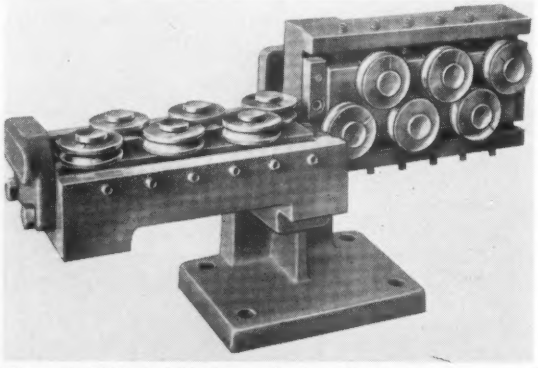

Figure 3. Roll straightening mechanism, showing arrangement of rolls.

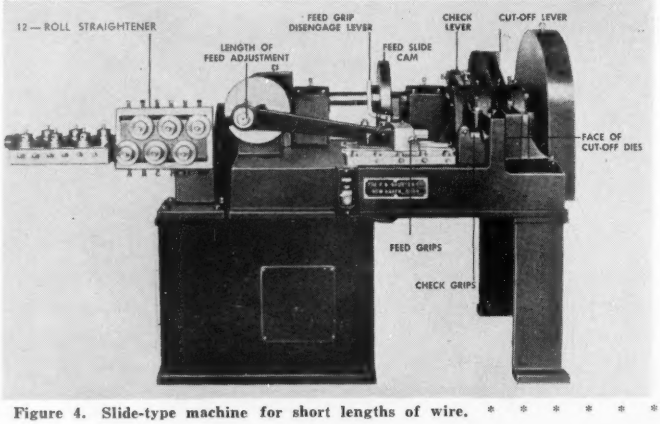

Figure 4. Slide-type machine for short lengths of wire.

finishes. Generally the iron and bronze dies are the most widely used and will provide excellent results for about 95% of all the present users of wire machinery.

★ ★ ★

The roll type straightener is basically two sets of rolls in different planes. This type straightener is most widely used for the straightening of flat and non-symmetrical stock. The roll straightener is not recommended on stiff, springy wire, especially if it is necessary to get the wire perfectly

Slide Feed

The slide feed is a machine designed especially for cutting short pieces of wire, from the coil, leaving the ends perfectly square. This machine fulfills the requirements for the manufacture of items like steel balls and pins of various kinds. See Figure 4. Slide feed machines employ a different manner of feeding the wire, resulting in large quantities of short lengths in a short period of time, as production rates can exceed 125 pieces per minute. The wire is drawn through the straightener by a gripping device and held in place by a check lever, while a second lever is provided with a shear that cuts off the predetermined lengths of wire.

Tube Straightener

The tube straightener is designed to handle thin walled tubing up to 1″ OD. The tubing is passed through a two-way geared rolling straightener. The tubing does not rotate and therefore no heat is created, which eliminates the possibility of tube swelling. Such machines have a speed range of up to 250 feet per minute.

Modern Developments

The key word of the engineering department today is "Automation." The goal is to develop machines that will cut and straighten greater amounts of wire in shorter periods of time, and have it done completely automatically. Many

(*Please turn to page* 475)

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The Ichabod Washburn Story

This article on an outstanding pioneer of the wire industry, the story of which latter cannot be told without mention of his name, appeared in the January, 1956, issue of "Wireco Life" and is republished here for the benefit of our readers, with the kind permission of the American Steel and Wire Division of United States Steel Corporation.

Like many pioneers in American industry, **Ichbod Washburn** started out as a poor boy, with nothing but his bare hands, his brain, and his ambition, in a free country. With them he built and developed the largest wire company known in the world up to the time of his death in 1868.

★ ★ ★

In the seaport town of Kingston, Mass., within a few miles of historic Plymouth, on August 11, 1798, there was born a pair of twin boys, **Ichabod** and **Charles Washburn.** On their mother's side they were direct descendants of **William Bradford,** who came over on the "Mayflower" and was for many years Governor of Plymouth Colony. On their father's side they were direct descendants of **John Washburn** who came to America on the third ship to Plymouth.

★ ★ ★

When the twins were but two months old their father, a sea captain, went to the aid of a floundering vessel off the coast of Portland, Maine. The ship's crew had been stricken with yellow fever and Captain Washburn, in the course of his rescue work, contracted the disease. With difficulty he reached his home in Kingston only to die three days later.

★ ★ ★

Aside from the homestead (still said to be standing in Sumner Street in Kingston) the mother, the twin boys, and an elder sister had little to support them and the mother was obliged to work at a hand loom in her home to earn their living.

★ ★ ★

The burden of family expenses finally became too great for the mother, and Ichabod, at less than nine years of age, was apprenticed or "put out to live" with **Abner Harlow,** a harness and truck maker in the next town of Duxbury. Here he paid for his living and learning by doing barn chores, building fires, chopping wood, and running errands.

★ ★ ★

Young Ichabod slept in an unused attic over the shop. This attic or loft was mainly without a floor, and Ichabod could reach his bed only by crawling along a ladder laid across the joists. On many a cold winter night the nine-year-old lad went to bed with all his clothes on, shivering throughout the long night with cold, fear, and lonesomeness.

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A few years later, at the age of 13, Ichabod returned home and we find him demonstrating his skill by making a harness for his cousin. So well was this work done that 50 years later parts of the harness were exhibited as a reminder of the craftsmanship of this young mechanic.

★ ★ ★

In 1813 Ichabod found work in a cotton factory and, as this was during the War of 1812 with England, he often took his turn watching at night for hostile British men-of-war.

★ ★ ★

During that winter he was engaged in running a power loom which was so crude and primitive that all of the cog wheels were made of wood. In spite of its crudeness, however, the loom stirred his interest in machinery and he was offered an opportunity to learn the machinist's trade.

★ ★ ★

He was discouraged from this by his guardian and others on the grounds that, "by the time his apprenticeship should expire the country would be so full of factories that there would be no more machinery to be built."

However, Ichabod's consuming interest in machinery and things mechanical could not be so easily quenched. A year later, in 1814, he seized the opportunity to learn the blacksmith's trade and was apprenticed to the Trask Brothers of Leicester, going there by way of Boston and Worcester.

★ ★ ★

Two years of Leicester, two more at Auburn and Millbury, Mass., and Ichabod turned up in Worcester as a journeyman blacksmith, engaged in forging machinery.

★ ★ ★

The next year, 1820, he joined with **William Howard** in the manufacture of machinery and lead pipe. Later he purchased Howard's half of the business and continued to manufacture lead pipe by himself.

★ ★ ★

Soon after this, in 1822, the demand for woolen machinery so increased that Washburn took as a partner one **Benjamin Godard,** organizing the firm of **Washburn & Godard.** This business increased until they employed some 30 men and had enlarged their buildings and facilities.

★ ★ ★

While engaged in the business of drawing lead pipe, the feasibility of drawing wire by machinery for the card-makers suggested itself to Washburn.

★ ★ ★

How to do it was the big question. Washburn was a good blacksmith and a fair machinist, but was wholly ignorant of "dies," "drawing frames," "annealing pots," "vitriol baths," and many other appliances, great and small, necessary for wire drawing.

★ ★ ★

With great pains the young blacksmith constructed his first

(*Please turn to page* 472)

Announcing the 1956

WEST COAST REGIONAL MEETING

OF

THE WIRE ASSOCIATION

JUNE 8, 1956, STATLER HOTEL, LOS ANGELES, CAL.

Registration will be at 10 A.M. at the Bethlehem Pacific Coast Steel Corp.'s plant. After a tour of the plant, the company will serve luncheon to its guests at approximately 1 P.M. The group will see the new electric furnace, rod rolling, the fastener division and the wire mill. In the afternoon, there will be a tour of the Pacific Tube Company's plant, where the production of cold drawn bars and various types of tubing may be seen.

A get-together and cocktail hour will precede the dinner at the Statler Hotel through the courtesy of a number of West Coast companies as a fitting prelude to the evening program. There will be a drawing for door prizes.

Mr. L. J. Soracco, Bethlehem Pacific's Sales Manager, will address the group after dinner. He has had both operating and sales experience and his talk should prove interesting.

THE PROGRAM COMMITTEE

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EARL R. POTTER, President and General Manager
Industrial Wire Products Corporation

R. G. TREMBLAY, General Superintendent
Bethlehem Pacific Coast Steel Corporation

The Association's Board of Directors is particularly desirous of having as many Eastern wire men present as possible and extend a cordial invitation to them to be in Los Angeles in June for this meeting. Hotel reservations can be made with Statler.

This will be a splendid meeting and all wire men are urged to be present. Further details next month.

RICHARD E. BROWN, ***Executive Secretary***

THE WIRE ASSOCIATION

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Government Wire Production Information

Report on Tungsten

General Services Administration has announced a saving of $2,429,000 by negotiating a reduction in a purchase contract for delivery of tungsten from foreign sources. Development of domestic sources of supply and sharply reduced requirements were given as the reasons.

★ ★ ★

A. J. Walsh, Commissioner of the GSA Emergency Procurement Service, said that when demand for tungsten was extremely high, at the begining of the Korean War, it contracted wih the **O'Okiep Copper Company** of the Union of South Africa, for the delivery of 120,000 short ton units of the metal to the U. S. through March 31, 1958. The contract was to involve an expenditure of about $7,000,000.

★ ★ ★

Deliveries resulting from its efforts to encourage domestic producers, as well as reduced needs, have enabled GSA to reduce the planned expenditure by $2,429,000. The company was agreeable to the cutback.

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Tungsten is a brittle, hard metal used principally in alloying steels. Its military applications involve use in gun barrels and armor plate. It is traded in "ton units"—a unit being 20 pounds of tungsten. If a ton of ore contains twenty pounds it is considered as containing one ton unit. Ore is paid for on the basis of how many ton units of metal are in each ton of ore.

Government Purchases

Quantities bought through December 31, 1955 under the Government's purchase programs for domestic tungsten, manganese, chrome, mica, beryl and asbestos have been reported by **Edmund F. Mansure,** Administrator of General Services.

★ ★ ★

The programs were established to stimulate the search for and the production of strategic and critical materials in the United States. They are separate from the exploration program of the Defense Minerals Exploration Administration, Department of the Interior.

★ ★ ★

Tungsten. Tungsten concentrates under the Government purchase program are accepted at various milling points, mostly in the West. The regulation setting up the tungsten purchase program was published in the Federal Register on May 11, 1951. Purchase of 3,000,000 short ton units (20 pounds each) of contained tungsten has

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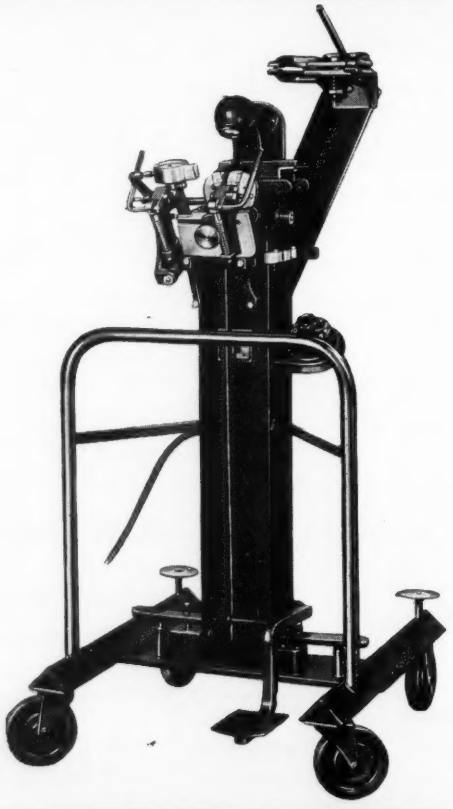
MODELS J-3-S and J-4-S AUTOMATIC MICRO-WELD BUTT WELDERS

These welders are used for welding high and low carbon STEEL, and STEEL ALLOY wire, ranging in size from .020" to .160" diameter. All operations on these units, which include the clamping of the wire being welded, contacting the welding switch, and upsetting the weld, are made by a single downward stroke of the foot pedal. Welders for high carbon steel wire are equipped with the exclusive MICRO-WELD Dial indicating annealing device to facilitate the annealing operation of high carbon wire.

Standard equipment with these units include annealing dies, filing vise, light extension cord, and mounting on a 4-wheel truck. Special units can be furnished for crane mounting.



MICRO PRODUCTS CO.

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Telephone: STATE 2-7468

been authorized. Delivered to date: 2,379,975 short ton units.

★ ★ ★

Manganese. Manganese is accepted at two depots—Butte and Philipsburg, Montana. Manganese is also accepted in carload lots at any rail point in the country. Depots at Wenden, Arizona, and Deming, New Mexico, have been closed after reaching their goals. The quantities authorized: 6,000,000 long ton units (22.4 pounds each) of contained manganese for Butte and Philipsburg together; 6,000,000 long ton units for Deming; and 19,000,000 long ton units for the carload program. Delivered to date: Butte and Philipsburg, 2,036,525 units; carload program 5,331,520 units.

★ ★ ★

Chrome. Chrome ores and concentrates are accepted at a depot at Grants Pass, Oregon. The program was published August 28, 1951. Purchase of 200,000 long tons of ores and concentrates has been authorized. Delivered to date: 101,634 long tons.

★ ★ ★

Mica. Mica is accepted at three depots—Spruce Pine, North Carolina; Custer, South Dakota, and Franklin, New Hampshire. It is accepted in three forms—block, film and hand-cobbed. The program was published March 15, 1952. Purchase of 25,000 short tons of hand-cobbed mica or the equivalent has been authorized. Delivered to date: 7,526 tons of all types at all depots.

★ ★ ★

Beryl. Beryl is accepted at three depots: Franklin, New Hampshire; Custer, South Dakota; and Spruce Pine, North Carolina. The program was published October 11, 1952. Authorized purchases: 1,500 short tons. Delivered to date: Total, in terms of program, 833 short tons.

★ ★ ★

Asbestos. Nonferrous crysotile asbestos in three grades, Crude Nos. 1, 2 and 3, is accepted at a depot at Globe, Arizona. Purchase of 1,500 short tons of Crude No. 1 and/or No. 2 has been authorized.

KEYSTONE XL COLD HEADING WIRE

SAVED . . . $13.26 PER M
Refrigerator foot level screw formerly made in two parts. Now cold headed from Keystone "XL" Wire.
SAVED . . . $46.15 PER M
This severely upset part was formerly made by another method—now cold headed at great savings.
flowability is the secret . . .
SAVED . . . $20.00 PER M
Another part now cold headed. Result—stronger, free from defects—savings up to $2,000 per year.
SAVED . . . $2.50 PER M
Critical dimensions required for this screw. Now produced by cold heading from Keystone "XL" Wire.

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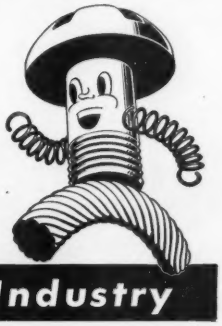
COLD HEADING SAVES CUSTOMERS TIME AND MONEY

Elco Tool and Screw Corp., cold heading specialists of Rockford, Illinois, have helped their customers save thousands of dollars. Four case histories are shown above—where cold heading replaced other forming methods at great savings.

The *flowability* characteristics of Keystone "XL" Cold Heading Wire has solved some of the toughest and most extreme heading problems. Because of this feature, Keystone "XL" Wire results in a better finished product, free from defects, greater die life, longer runs and lower costs. Keystone quality now makes it possible to cold head parts that were formerly hot headed or machined.

Keystone does not cold head parts, but your cold heading source can tell you how you can save important dollars in time and materials when the right wire—Keystone "XL" Wire—is applied to your fastener or parts problem!



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He knows the problems of the cold heading industry. He can help you apply the right wire to the job. For immediate information, send for new booklet—*"Facts About Cold Heading Wire."* Write to . . .

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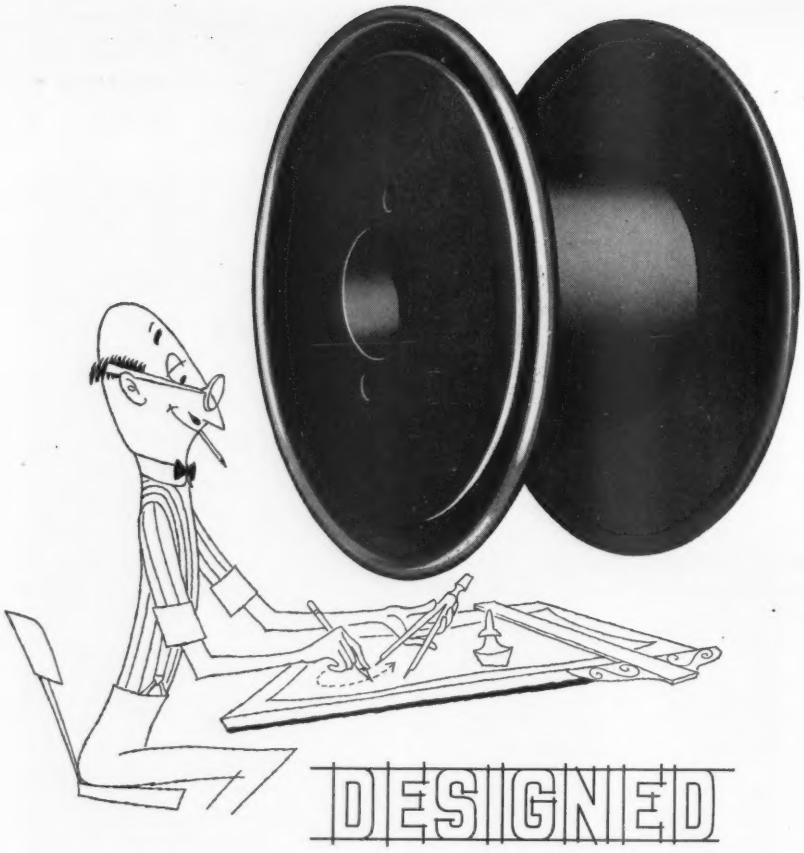
KEYSTONE WIRE *for Industry*



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APCO MOSSBERG COMPANY

ATTLEBORO, MASS.

Crude No. 3, which is accepted on a tie-in basis with the other two grades, is not figured into the quantity authorized. Delivered to date: Crude No. 1 and No. 2, 1,261 short tons; Crude No. 3, 645 short tons. Total, in terms of program, 1,261 tons Crude No. 1 and 2.

NBS Publication on Instrumentation

"Guide to Instrumentation Literature" by **W. G. Brombacher, Julian F. Smith,** and **Lyman M. Van der Pyl, National Bureau of Standards'** Circular 567, issued December 14, 1955, 156 pages, may be purchased at a cost of $1.00. It can be ordered from Government Printing Office, Washington, D. C.

★ ★ ★

This circular is intended to assist research investigators, instrument users, and others interested in utilizing the extensive and scattered literature of instrumentation. It was prepared as part of the program of instrumentation research and development which is cooperatively sponsored at the National Bureau of Standards by the Atomic Energy Commission, the Office of Naval Research, and the Air Research and Development Command.

★ ★ ★

Over 1200 references are listed, including abstract journals, bibliographies, 660 books on technology, directories of manufacturers, guides to and indexes of technical literature, periodicals of interest, and guides to dissertations, patents and specifications. Articles published in periodicals are not referenced, but indexes and abstracts of such articles on a given subject are indicated in the subject index.

★ ★ ★

(Foreign remittances must be in U. S. exchange and should include an additioinal one-third of the publication price to cover mailing costs.)

The Bureau of Mines Reports on The Copper Industry in 1955

Supplies of copper in the United States in 1955 were about 5 per-

cent larger than in 1954, chiefly because domestic mine output rose 19 percent, according to the Bureau of Mines, United States Department of the Interior. Althoug production increased it did not reach the high level promised by expanded operating rates at established as well as new mines; this failure resulted chiefly from serious work stoppages at several important mines in the third quarter of the year. Consumption of refined copper rose more than production on a tonnage basis. Prices of domestic copper moved upward sharply during the year, but because foreign prices rose even more sharply did not attract increased quantities of metal from abroad to the United States market. Thus, supplies did not cover requirements in 1955 as had been expected. The Government, to assist in alleviating the inadequte supply situation, permitted postponement of stockpile deliveries, authorized sale of metal from Defense Production Act inventories, and banned or curtailed exports of domestic refined copper and copper scrap and copper-alloy scrap.

★ ★ ★

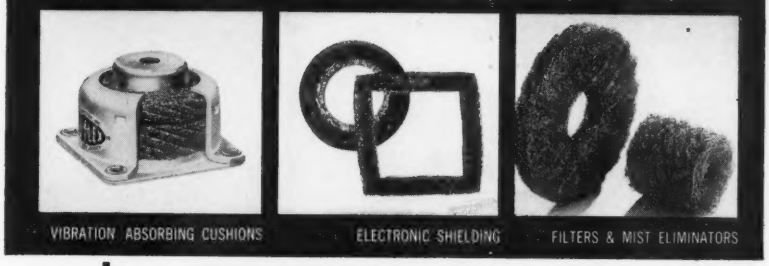
Mine output rose from 835,000 tons in 1954 to 993,000 tons in 1955. The increase reflected in large measure new output from properties put into production in 1953 and 1954. Only one large mine —the San Manuel—started to produce in 1955; two units of the San Manuel mill were put into operation in November.

★ ★ ★

Consumption of refined copper in the first eleven months of 1955 exceeded that in the like period of 1954 by 21 percent; data for December are not yet available. In the first quarter of the year refined copper consumption averaged 124,400 tons monthly; in the second 132,900; in the third 99,000; and in October and November 144,900. The poor showing in July to September was caused by brass mill vacations in July, by disastrous floods due to August hurricanes in the principal brass-making area of the country, and by reduced supplies caused by the production strikes already mentioned.

Engineers have taken to **KNITTING** with **ALLOY WIRE...**

Look at the results they're getting...



If you haven't started to investigate the design potential for knitted stainless steel and nickel alloy wire, now is the time to do it. Here are some interesting applications to whet your interest and imagination:

1. **VIBRATION & SHOCK ABSORBING CUSHIONS** — used to protect intricate, expensive electronic equipment in aircraft. Alloy wire is unaffected by high temperatures, low temperatures, moisture and other elements.
2. **ELECTRONIC SHIELDING** — knitted alloy wire gaskets eliminate radio interference in electronic equipment. Nickel alloy wire has good conductivity, corrosion resistance and resiliency.
3. **FILTERS & MIST ELIMINATORS** — knitted wire pads remove entrained liquids from gas streams with exceptionally low pressure drop. Shaped cartridges widely used for oil and other liquid filters.

Many other industrial applications take advantage of the outstanding properties of knitted alloy wire. Learn more about these interesting products . . . send today for Application Bulletin A-1.

ALLOY HKP

ALLOY METAL WIRE DIVISION

H. K. PORTER COMPANY, INC.
Prospect Park, Pennsylvania

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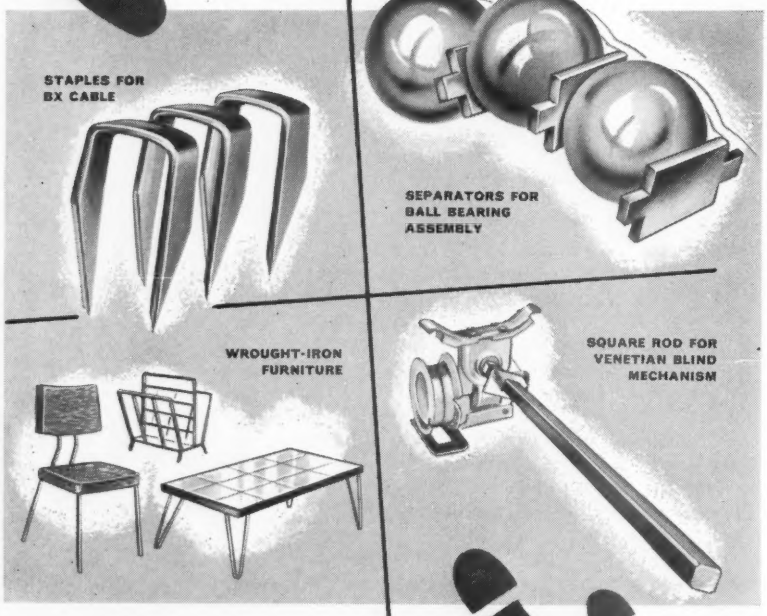
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Practically any temper, finish, or analysis in low carbon and medium low carbon steels can be specified to give you the *right* wire for the job—including #3 finish wire for electroplating.

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PRODUCERS OF Manufacturers' Wire in many sizes, shapes, tempers, and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, and special wire. Also, Coated Steel Sheets, Nails, Continental Chain Link Fence, and other products.

The high figures for October and November reflected in part consumers' efforts to overcome the effects of the unfavorable record for the third quarter.

★ ★ ★

The principal producers' quoted price for domestic electrolytic copper delivered in the United States averaged 37.5 cents a pound in 1955, or 25 percent more than in 1954. These producers raised their quotations from 30 to 33 cents in January, to 36 cents in March, and to 40 and then 43 cents in August, which quotation prevailed beyond the end of the year. All these prices were below those in European markets. Some United States metal, on the other hand, was sold at prices above those of the principal producers and at times the price for custom metal approximated those on the London Metal Exchange, discussed later in this report.

★ ★ ★

According to the Department of Commerce, in the first 11 months of 1955, 535,581 tons of copper was imported in unmanufactured form, compared with 543,764 tons in the same period in 1954. Chile was the source of 38 percent of the total whereas in all of 1954 Chile furnished 45 percent; in 1953, 42 percent and in 1952, 59 percent. Thus, if in 1955 Chile had maintained its customary position, total United States imports would have been larger than in 1954.

★ ★ ★

Refined copper imports declined 11 percent compared with the first 11 months of 1954, owing to a drop to half in receipts of this class from Chile. Imports of unrefined copper from Chile rose 16 percent, whereas the total from all countries showed virtually no change.

★ ★ ★

In June suspension of the excise tax on copper was extended for another three years, or to June 30, 1958.

★ ★ ★

Exports of refined copper, by far the chief export classification, in January to November 1955, de-

creased 7 percent from the first 11 months of 1954. Brazil was the only non-European country to take as much as 4 percent of the 1955 total, and in 1954 was also the only leading destination outside of Europe of refined copper exported from the United States.

★ ★ ★

Because of the inadequate supply situation, on February 7 the Department of Commerce virtually banned exports of copper refined from domestic primary materials, and limited the total tonnage of copper and copper-alloy scrap exported. Effective March 10, copper and copper-base alloy wire, and cable were added to the positive list to require licenses for shipment to all destinations except Canada. On July 26 exports of foreign copper (formerly without quota) in the third quarter, were restricted to 54,000 tons. Exports of scrap were further restricted.

★ ★ ★

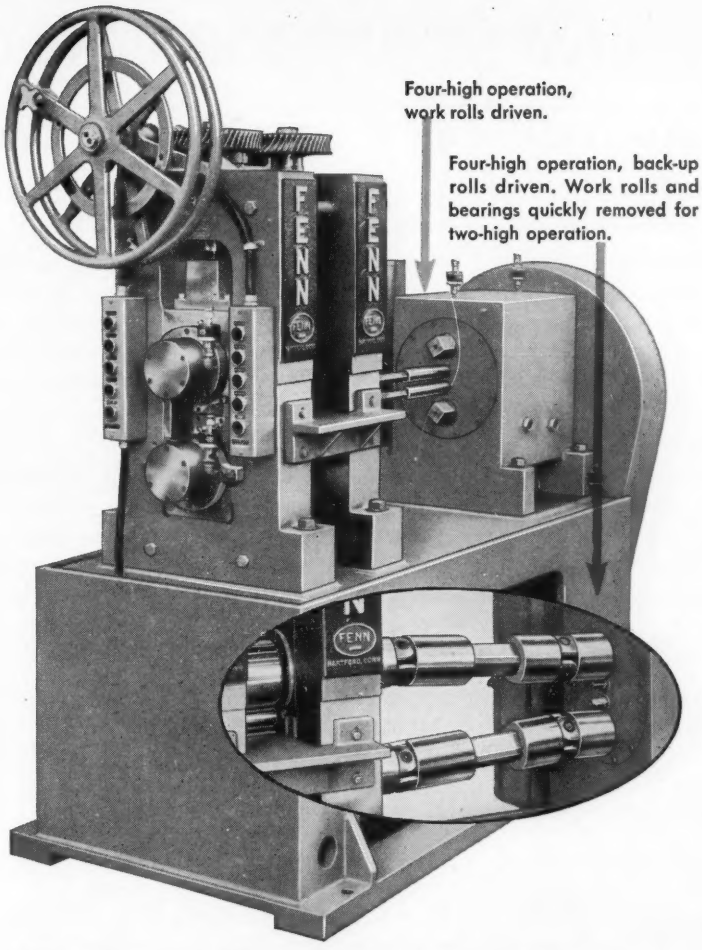
Producers' stocks of refined copper rose 20 percent in 1955 but continued small and totaled only 30,000 tons. Producers' stocks of blister and materials in process of refining at the year end were virtually unchanged from those on hand January 1.

★ ★ ★

The world situation, like that in the United States, was one of inadequate supply caused by large-scale consumption combined with production losses induced by major strikes. Despite the losses, however, world mine production in 1955 established a new all-time peak of about 3,300,000 short tons, or about 7 percent more than in 1954; the increase resulted chiefly from gains in the United States, Chile and Canada.

Hex Cap Screw Practice Recommendations

A proposed Simplified Practice Recommendation for Hexagon Head Cap Screws (Case Quantity and Gross Weight), has been submitted to producers, distributors, and users, for acceptance, the **Commodity Standards Division,** Office of Technical Services, U. S. Department of Commerce, reports.


Four-high operation, work rolls driven.
Four-high operation, back-up rolls driven. Work rolls and bearings quickly removed for two-high operation.
FENN
FENN

Unique three-way drive gives unlimited flexibility

Fenn's new combination laboratory rolling mill may be operated as...

- Two-high
- Four-high, work rolls driven
- Four-high, back-up rolls driven

Efficient operation is assured over a complete range of reductions, extra-high bearing capacities permit substantial reduction of the newest, toughest materials.

Fenn engineering is at your service to roll samples of your material, to furnish practical and theoretical assistance as needed.

FENN

Precision Rolling Mills — Turks Heads — Wire Shaping Mills
Swaging Machines — Wire and Tube Drawing Machines

The Fenn Manufacturing Company, 601 Fenn Road, Newington, Connecticut

EFFICIENT, MODERN SYSTEMS FOR ELECTRICAL WIRE & CABLE MANUFACTURING

• *CABLE LACQUERING SYSTEMS*

Conventional cellulosic, or other type, lacquers are applied in successive continuous coats from one to twenty-eight coats over fibrous braid wrapped primary conductors. One end, four ends, or eight ends of wire are handled continuously. System includes letoff, application, drying and constant tension takeup equipment.

• *WIRE ENAMELING SYSTEMS*

Natural and synthetic enamels, silicones, solution nylon, modified plastisol, and similar insulating coatings are applied to bare, cotton or glass covered wire in round, square or rectangular cross section. Ten or twenty simultaneous strands are handled. Systems are complete with letoff, preannealer, application system, capstan and multiple takeup unit.

• *ASBESTOS INSULATING SYSTEMS*

Carded asbestos is applied to continuous single conductor as an integrated operation with saturating, rotary forming, drying, cooling and polishing of the finished wire. Wire from No. 20 gauge to No. 6 AWG is handled through an asbestos wall thickness range of from .008″ to .040″ thickness in a single pass.

• *RUBBER OR PLASTIC JACKETING SYSTEMS*

Rubber and thermoplastic jacketing compounds are continuously applied to electrical wire or cable by the extrusion method. High speed, constant tension letoff and takeup equipment, controlled cooling or continuous vulcanizing equipment are powered by synchronized range drives as complete, integrated wire handling systems. Extrusion machines of customer's choice are furnished.

• *GLASS & VARNISH COATING SYSTEMS*

Double layer of glass or cotton wrapping is applied to round, flat or square conductor. Two individual coatings of high temperature varnish are applied and the finish baked in a continuous operation. Units are complete from letoffs to takeup frames.

• *SELF TRAVERSING REEL CORD DRYERS*

These ingenious machines are used to remove hygroscopic moisture from fibers, braided or knitted flexible cable. These machines increase extrusion speeds, reduce blister scrap loss and improve diameter control. They are easily installed in existing extrusion line.

TECHNICAL INFORMATION ON ANY OF THESE PROCESSES UPON REQUEST

C. A. LITZLER CO., INC.

11621 DETROIT AVENUE

CLEVELAND 2, OHIO

The recommendation, proposed by the United States Cap Screw Service Bureau, consists of a schedule of case quantities and approximate gross weights for hexagon head cap screws ranging in size from 3/8 to 6 inches in length, and from ¼ to 1 inch in diameter.

★ ★ ★

Mimeographed copies of the proposed recommendation may be obtained from the Commodity Standards Division, Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Directors to Meet in New York

The semi-annual meeting of the Board of Directors of THE WIRE ASSOCIATION will be held at the Commodore Hotel in New York City at 10:00 A. M., Friday, April 20, 1956, to consider matters of importance to the Association. All directors are urged to be present.

Wire Brushes for Deburring Spools

Nicks and burrs on the flanges of wire spools can be brushed out and the edges left smooth by a new Wire Spool Deburring Machine designed and manufactured by the **Fuller Brush Company,** Machine Division.

★ ★ ★

The handling of empty spools on which fine wire is to be loaded can cause nicks which cut or damage the wire during loading or paying-off. This results in production breakdowns either at the wire plant or at the user's plant. When returned spools have been deburred before reloading, both the wire producer and customer benefit from a reduction in time loss.

★ ★ ★

To smooth out the nicks, the spool is placed by hand on a spindle that revolves slowly against four revolving bevel trimmed Full-anchor brushes of steel wire which deburr both sides of the top and bottom flanges simultaneously.

★ ★ ★

For further information, write The Fuller Brush Company, Machine Division, Hartford 2, Conn.

Outstanding Personalities of the Wire Industry

To Manage Plastic Production

Robert U. Haslanger has been elected Vice President and General Manager of **Escambia Bay Chemical Corp.,** 70 Memorial Drive, Cambridge 42, Mass., it has been announced by **Kenneth G. Donald,** President.

★ ★ ★

Escambia Bay operates a plant at Pensacola, Florida, where ammonia, ammonium nitrate, and nitrogen fertilizer solutions are produced. Construction is now under way at the same site for a 30,000,000 pound polyvinyl chloride resin plant to be completed by the fourth quarter of this year.

★ ★ ★

Mr. Haslanger has a broad background for his new assignment. For a number of years he was with **Monsanto Chemical Co.,** where he held various posts in research, product development and sales. He served in the General Development Department and then as Assistant to the President, and later, as Assistant General Manager of the Western Division. Next, he became General Sales Manager of the Texas Division. When this became part of the Plastics Division, he assumed the duties of Director of Sales for Raw Materials.

★ ★ ★

More recently Mr. Haslanger was with **Stauffer Chemical Co.** as Assistant to the President and Director of Sales, Industrial Chemicals. He is a graduate of the University of Wisconsin.

Rockwell's Furnace Sales

Charles W. Hanlon was recently appointed Sales Manager of the Furnace and Oven Division of **W. S. Rockwell Co.,** 196 Eliot St., Fairfield, Conn.

★ ★ ★

He has had a long experience in the industrial furnace field and comes to Rockwell from Houck Manufacturing Co., where he spent 14 years, starting as a shop trainee and rising to sales manager of the engineering division and then becoming executive secretary of the company.

★ ★ ★

Mr. Hanlon put in a term of service with the U. S. Air Force, where he rose from private to Colonel. His record includes 184 battle missions, for which he received several medals and decorations.

Three J & L Men Promoted at Muncy

Three promotions have been announced at the Muncy, Pa. Wire Rope Division Plant of **Jones & Laughlin Steel Corporation.**

★ ★ ★

Glader—Years of Proven Performance
GLADER NAIL MACHINES
55 YEARS of experience meeting the exacting demands of nail making.
The machine with a record of steady dependable service.
Wm. GLADER MACHINE WORKS
210 N. RACINE AVENUE
CHICAGO 7, ILLINOIS
Export Dept.: 122 East 42nd Street, New York 17, N. Y.

Grant H. Carpenter has been promoted to Assistant to the Plant Manager. He formerly was Chief Metallurgist for the Wire Rope Division.

★ ★ ★

C. T. Evenden has been named Chief Service Engineer. He formerly was Service Engineer.

★ ★ ★

W. H. Myers has been appointed Metallurgist at the Muncy plant. He formerly was a Process and Development Engineer.

Kennecott Promotes Barney

The appointment of **Walter G. Barney** as vice president and assistant general manager of **Kennecott Wire & Cable Company** has been announced by **A. F. Sheldon,** president. Kennecott Wire & Cable Company is a subsidiary of Kennecott Copper Corporation.

★ ★ ★

Mr. Barney, who has served as purchasing agent, will continue to supervise the activities of the purchasing department along with his new duties.

★ ★ ★

Upon graduation from Brown University in 1936 he joined Kennecott organization as a member of the Production Control Department. During World War II he was supervisor of priorities for the company.

Seymour Appointments

Alexander P. Raeburn was recently elected treasurer of the **Seymour Manufacturing Co.,** Seymour, Conn.; **John D. Berwick, Jr.,** was appointed general superintendent, Manufacturing Div. and **Stephen J. Zelle** was named chief engineer, Engineering and Maintenance Div.

Joins Rockbestos Products

Paul W. Becker has joined the **Rockbestos Products Corporation,** New Haven, manufacturers of insulated wires and cables. He will be Vice-President in charge of Manufacturing, it was announced by President **Albert S. Redway.**

★ ★ ★

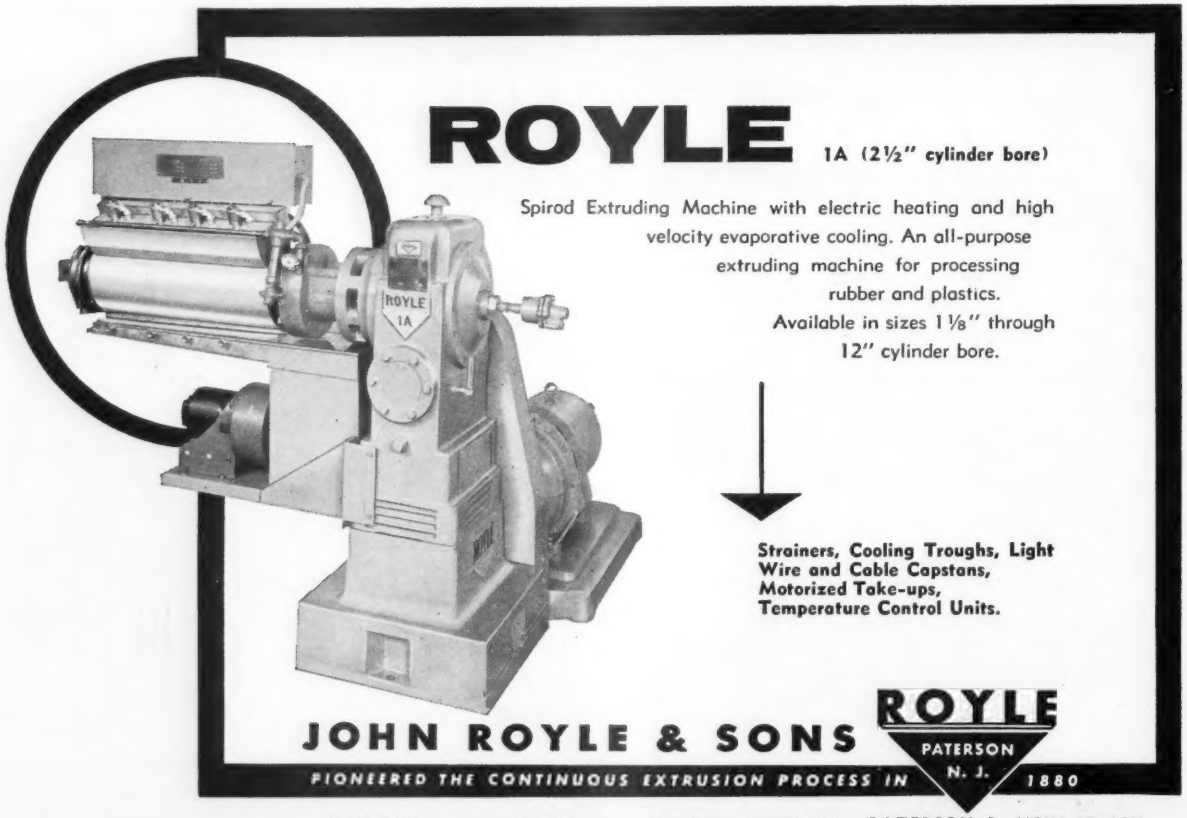
Mr. Becker, a native of Syracuse, New York, is a graduate of Hamilton College and joins Rockbestos after thirty years experience in the wire and cable industry.

★ ★ ★

For the past seven years he has been plant Manager for the **Electric Auto-Lite Company** at the Hazleton, Pennsylvania plant. Prior to his association with Auto-Lite, he spent seventeen years with **General Cable Corporation,** four years with **Anaconda Wire and Cable,** and was later associated with the **Plastic Wire and Cable Company.**

★ ★ ★

In announcing this appointment, Mr. Redway stated that Mr. Becker's broad experience will enable Rockbestos to rapidly carry out the modernization program now under way and at the same time enable the plant to develop new and improved products.


ROYLE
1A (2½" cylinder bore)
Spirod Extruding Machine with electric heating and high velocity evaporative cooling. An all-purpose extruding machine for processing rubber and plastics.
Available in sizes 1⅛" through 12" cylinder bore.
ROYLE
1A
Strainers, Cooling Troughs, Light Wire and Cable Capstans, Motorized Take-ups, Temperature Control Units.
JOHN ROYLE & SONS
ROYLE
PATERSON N. J. 1880
PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN
London, England James Day (Machinery) Ltd. Hyde Park 2430 - 0456
Home Office V. M. Hovey J. W. VanRiper SHerwood 2-8262
Akron, Ohio J. C. Clinefelter SWandale 4-5020
Los Angeles, Cal. H. M. Royal, Inc. LOgan 3261
PATERSON 3, NEW JERSEY

Republic Steel Appointments

David E. Weaver has been appointed assistant superintendent, South Chicago Works, **Republic Steel Corp.; Ludrick Kukulinski** has been appointed superintendent, Mechanical Dept., Youngstown District and **Alexander Carnie** has been named chief division engineer, Truscon Steel Div., Youngstown, O.

To Head Manufacturing for Wire Products Company

United Steel & Wire Company, Battle Creek, Mich., has announced the appointment of **J. Milton Shatzel** as Director of Manufacturing.

★ ★ ★

At the same time it was announced that **Louis C. White** had been made assistant to the president and Director of Industrial Relations.

Mordica to Represent Pennsalt in Chicago

John Mordica has been named field sales supervisor for drawing lubricants in the **Pennsylvania Salt Manufacturing Company's Metal Processing Department,** operating out of the Chicago territory, sales manager **Joseph J. Duffy** has announced.

★ ★ ★

Mr. Mordica was on the sales staff of **Gilron Products Company** when that organization was acquired by Pennsalt Chemicals in November, 1954 and later integrated with its Metal Processing Department. In his new assignment he will service accounts in the Chicago area and supervise sales of Drawcote lubricants and specialties to auto bumper plants.

★ ★ ★

A veteran of 25 years in the metal processing field, Mr. Mordica was on the sales staff of the Firth Steel Company and with the Wire Division of Bethlehem Steel prior to his 9-year association with Gilron. He received his technical education at the University of Maryland.

Appointed Production Manager of Torrington Manufacturing's Machine Divsion

Clifford R. Kral has just been appointed Production Manager of the Machine Divison of **The Torrington Manufacturing Company,** producer of wire-forming machinery, mill machinery and air impellers at Torrington, Conn., with manufacturing branches in Van Nuys, Calif. and Oakville, Ontario. In his new position, he will be fully responsible for all operations of the Machine Division's Manufacturing Department, including estimating and production planning. He will report directly to **G. H. Froelich,** vice-president and general manager of the Machine Division. Mr. Kral has been with Torrington Manufacturing since 1946 first as chief estimator and then planning manager with the Machine Division.

Titan Metal Appoints Executives

Titan Metal Mfg. Co., Bellefonte, Pa., has elected **Grey W. Tressler** vice president-manufacturing; **Marvin J. Rothrock,** vice president and director of purchases; **Ralph H. Lightner,** vice president-sales manager and **H. Chapman Ward,** vice president-cost controller. **W. E. Dunnick** was made works manager.

MASON lightweight, non-returnable, lithographed spools for:

INSULATED WIRE
AUTOMOTIVE CABLE
THERMO-COUPLE WIRE
TV LEAD-IN WIRE
SOLDER WIRE

IF you want dependable performance and attractive appearance—at a low, low cost—put Mason Spools at the top of your list!

Over 175 leading manufacturers can attest to the performance of Mason Spools. As for appearance... the rich, colorful perfection of Mason lithography is your best assurance of *instant brand identification.*

Mason Spools are available in 5", 6½", 8½", and 10½" head sizes. All sizes available with 1⅞" (Dia.) barrels. The 10½" head size is available with a 3½" (Dia.) barrel. Barrel lengths from ⅝" to 14".

Let us know about your spool requirements *now!* Telephone East Providence 1-2810 or write to the address below.

MASON CAN COMPANY
1949 Dexter Road, E. Providence 14, R. I.
Branch Plant — Greenville, Ohio

Davis-Standard Appoints Sales Office Manager

B. H. Davis, Director of **Davis-Standard Sales Corp.,** Mystic, Conn., recently announced the appointment of **Joseph T. Marie** as Sales Office Manager. Mr. Marie has been with the Davis-Standard since February, 1953, and his first assignment was that of Assistant Purchasing Agent. This was followed by service in the Cost Department and then in the Sales Department as Cost Sales Co-ordinator.

★ ★ ★

His newly assigned duties will include responsibility for the co-ordination of all sales activities of the company, which is the sole selling agent for **The Standard Machinery Company.** They handle a complete line of wire machinery and high quality extruders for rubber and plastics, including the exclusive Therma-Fin Extruder.

L. A. Young Spring & Wire Celebrate 50th Anniversary

March 14th marked the fiftieth birthday of the **L. A. Young Spring & Wire Corp.,** Detroit, leading manufacturer of springs for the automotive and other industries, as well as a wide variety of wire forms.

★ ★ ★

The company employs 6,000 persons in 15 plants in the U. S. and Canada and has a total manufacturing floor space of 2,086,000 square feet.

★ ★ ★

In the last decade of the years leading up to its Golden Anniversary, the company has enjoyed the most successful period in its history.

Correction

On page 213 of the February issue a news item announced that **Frederick L. Erminelli** had been appointed New England representative of the **James L. Entwistle Co.** (now Entwistle Mfg. Co.).

★ ★ ★

Mr. Erminelli advises that he did not accept the appointment and has severed his connection with the aforesaid company as of January 4th.

Norton Elects New Director and Officers

A new director and three new officers were named by **Norton Company** at its 71st annual meeting of stockholders and directors.

★ ★ ★

Edwin C. Evans, 45, of Troy, N. Y., was elected a director. He is also vice president and assistant general manager of Norton's Behr-Manning Division located at Troy. Mr. Evans will fill the vacancy created by the death of John M. Cook, who died last May.

★ ★ ★

Howard J. Daly, 58, of 920 James Avenue, Niagara Falls, N. Y., was elected to the new post of vice president in charge of crude abrasive plants. He has been manager of Bauxite and crude abrasive plants since 1949 and a director since 1953.

★ ★ ★

William H. Perks, 43, of 1160 Pleasant Street, Worcester, was appointed assistant treasurer in addition to his present position as controller.

★ ★ ★

Sheffield's **KONE-PAK** (patent applied for) is a stout cone-shaped steel frame on which we spool the wire. The whole deal is mounted on a disposable wooden pallet. Packaged in a super-strength cardboard container if desired.

Sheffield Wire in New KONE-PAK can cut your production costs 3 ways!

SHEFFIELD
Manufacturers' Wire

You know your costs on unloading a car containing 100 to 2000 coils of wire. Compare that to picking up and moving 50 compact KONE-PAKS on a pallet handling truck.

Here's other ways you save with KONE-PAKS: (1) Fewer units stored in more compact space; (2) faster set-up for threading into machines; (3) bigger "feedings" for machines; fewer loadings and less dead time.

Of course the best packaging plays second fiddle to what's inside. In this case it's the best wire of its kind—quality-controlled every step of the way from Sheffield furnaces to finished product. Watch your production costs shrink with Sheffield Wire—now with the big plus of KONE-PAKaging.

Products of
SHEFFIELD STEEL
DIVISION
ARMCO STEEL CORPORATION
SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

Curtis M. Clark, 41, of 10 Prospect Street, Shrewsbury, was appointed assistant secretary. He has been counsel since 1951.

★ ★ ★

George N. Jeppson was re-elected chairman of the board of directors and **Milton P. Higgins** was re-elected president by the directors.

To Direct Sales for Waterbury Farrel

Richard C. Bannon, Vice President and Director of **Waterbury Farrel Foundry and Machine Co.,** Waterbury, Conn. has been made Vice President in Charge of Sales. Waterbury Farrel manufactures a varied line of bolt, nut and screw machinery, power presses, rolling mills and wire mill equipment.

★ ★ ★

Mr. Bannon has been District Manager of the Cleveland Sales Office since 1941. He was elected Vice President in March, 1954, and was made a Director in March, 1955. The appointment became effective January 1, 1956. He is a graduate of Yale University, 1923, having joined the company in the same year.

Firth Sterling Appoints Service Engineer

Firth Sterling, Inc. has announced the appointment of **Francis J. Kolpek** to its staff of Carbide Service Engineers. He will be located in Cincinnati, Ohio.

★ ★ ★

Before joining Firth Sterling, Mr. Kolpek was associated with National Tube Christie Park Works of Pittsburgh where he was general foreman for four years. Prior to that, he was employed as assistant foreman by Bastian Blessing Company.

★ ★ ★

Mr. Kolpek attended Chicago Tech and Northwestern University where he completed courses in machine design and industrial management respectively.

G. E. Appoints Department Manager

Dr. George E. McCullough has been named Manager - Process Development, in **General Electric Company's** Chemical Development Department, according to a recent announcement by **R. H. Krieble,** Manager of the Department for G-E's Chemical and Metallurgical Division.

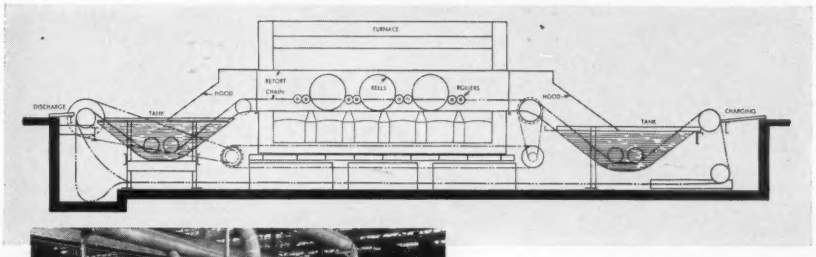
★ ★ ★

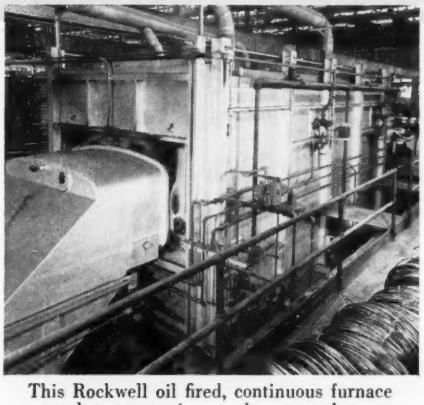
Dr. McCullough joined General Electric in 1948 at Schenectady, at the G-E Research Laboratory. In 1950, he was transferred to the Hanford Atomic Power Operation as Manager - Pile Technology, returning to Schenectady in 1955. His headquarters will be at #1 Plastics Ave., Pittsfield, Mass.

A S & W Man Advanced to Staff Assistant

Gaylord B. Barnes has been appointed staff assistant to the president of **American Steel & Wire Division, U. S. Steel Corp.,** Cleveland, to replace **Richard Kimmel,** who was recently made administrative assistant to the vice president-general manager of the division's Cyclone Fence Department at Waukegan, Ill.

Bright Anneals Copper Wire at Lowest Cost





This Rockwell oil fired, continuous furnace anneals copper wire on drums at the rate of 120,000 lbs. per 24 hrs. Drums travel 4 abreast. The work is carried through the exit hood, in foreground, into a steel water tank for quenching, without exposure.

The "wet" method of annealing copper wire (to be subsequently rubber covered), is a Rockwell development that has proved very efficient in operational simplicity, production quality, and labor and space saving.

Drums of coiled wire move continuously, from the wash or other process through a wet or dry seal, then through the alloy retort of the furnace, exit hood, water quench and discharge.

The reels or drums of wire travel several abreast, being rolled along the tanks and retort floor by pipe rollers attached to the alloy link chain conveyor. Length of processing system depends on production needs.

The furnace may be gas or oil fired, or electric. Annealing atmosphere may be provided to assure desired brightness of metal.

It will pay you to learn more about this and other types of Rockwell wire heating equipment. Get Bulletin 432.

ROCKWELL ALSO BUILDS

Batch and continuous furnaces and ovens for annealing, aging, drying, enameling, tinning, glass coating, synthetic coating. Atmosphere generators.

W. S. ROCKWELL COMPANY

FURNACES • OVENS • BURNERS • VALVES • SPECIAL MACHINERY

2426 ELIOT STREET • FAIRFIELD, CONN.

Sales Representatives in Principal Cities

To Head Sales for Elgin's Abrasives Division

The Abrasives Division of **Elgin National Watch Company** has appointed **William H. Baudouine** new division sales manager, according to **C. R. Myer,** general manager of the division. The company's carbide tool program currently is being expanded.

★ ★ ★

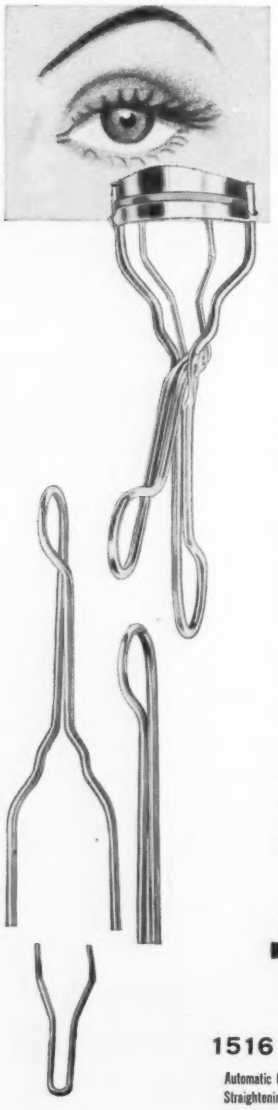
Mr. Baudouine will also direct national sales of Elgin's diamond abrasives and Elgiloy, the noncorrosive spring material.

★ ★ ★

He joined Elgin in 1953 as sales engineer and had covered the Northern Illinois territory, including Chicago. A graduate of Northwestern University, he holds a degree in mechanical engineering.

Correction

In a news item appearing on page 208 of the February issue announcing the moving of the **American Manufacturing Company** to 50 Millbrook St., Worcester 5, Mass., the name of William J. Maher was erroneously given as Vice President. The Vice President of this carbide die manuaftcuring concern is **Bernard W. Hall.**



THIS WILL CURL YOUR EYELASHES

A Nilson #2 Four-Slide Automatic Wire Forming Machine is being used by Rollash Corporation, Brooklyn, N. Y., to form wire as shown for their eyelash curler . . . complete in one operation. After one year's operation they report savings of—

40% on actual manufacturing costs
15% on improved tooling which eliminates secondary operations.
10% on fewer rejects, full parts control assuring top precision.
. . . elimination of freight charges by making parts on premises . . . advantage of immediate access to production.

TOTAL SAVINGS . . . OVER 65%

NILSON 4-SLIDES FEATURE

- One-man operation
- Forming of wire or ribbon metal from coil
- One fast, automatic operation straightens, feeds, pierces, blanks, stamps or coins, cuts off, forms
- Critical tolerances up to .002" on any runs
- Fast tool and die changing
- Wide size range—forms wire up to ½" dia. in feeds to 32" max. Ribbon stock up to 3½" wide.
- Press sections 5 to 30 ton cap.
- Heavy duty models 50—75 ton cap.

Without obligation, Nilson provides specific forming recommendations from detailed information. Send for A. H. Nilson catalogs . . . the first step in increased production.

A.H. NILSON MACHINE COMPANY

1516 RAILROAD AVENUE, BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

Marshall Richards Appoints Chief Electrical Engineer

Marshall Richards Machine Co., Ltd., Crook, County Durham, England, has announced the appointment of **A. Hurst** as Chief Electrical Engineer, replacing **T. B. Sommerville,** who resigned from this post and the Board in January. Mr. Hurst is well known to many Marshall Richards customers and suppliers through his previous contacts with them for the company.

Assigned to New Goodrich Post

James L. Foster, associated with **B. F. Goodrich Chemical Company** since 1944, will move to a new assignment with **Goodrich-Gulf Chemicals, Inc.,** on January 1. He will report to J. E. Miller, general sales manager.

★ ★ ★

Mr. Foster is a native of Manhattan, Kansas. He attended Kansas State college and was graduated in 1937 with a B. S. degree in industrial chemistry.

★ ★ ★

He joined BFG Chemical Company in 1944 as a development engineer in the chemical laboratory. In 1949 he moved to the technical services department and in early 1950 was assigned to wire and cable materials sales department as a technical representative, a position he retained until his present appointment.

Northwestern S. & W. Names Sales Manager

C. S. Wagner has been appointed manager, sales, Merchant Trade Products by the **Northwestern Steel & Wire Co.,** Sterling, Ill.

Metal Carbides Adds to Sales Staff

Metal Carbides Corporation, Youngstown, Ohio, announces the addition to the Detroit sales office of **Butler Brewen,** District Sales Manager, formerly associated with Sandvik Steel Co. and Vascaloy-Ramet Corp.; and **Donald Coats,** formerly associated with the Carboloy Co., who will serve as a sales representative.

A S & W Appoints Staff Assistant

Appointment of **Gaylord B. Barnes** as staff assistant to the president was announced today by **W. F. Munford,** president **American Steel & Wire Division of U. S. Steel Corp.** Mr. Barnes will replace **Richard Kimmel** who recently was appointed administrative assistant to the vice-president and general manager of the Division's Cyclone Fence Dept. in Waukegan.

★ ★ ★

He began his employment with United States Steel Corp., in 1942, when he was employed as a technical apprentice at the Wire Division's Steel and Wire Works in Donora, Pa. After successive advancements, he came to Cleveland in May, 1955, as an assistant staff industrial engineer in the general offices, the position he held prior to his latest appointment.

Personnel Changes at Plastic Mold

E. C. Scanlon, President of **Plastic Mold & Engineering Co.,** 157 Clifford St., Providence 3, R. I., manufacturers of braider bobbins and Nylon wire braider spools has announced that, due to illness, **Ward A. Robinson,** Sales Manager, has been granted leave of absence. **James Beattie** has been appointed Production Manager and **Edythe Sperry,** Sales Promotion Manager.

Mrs. Walter A. Richards

Mrs. Jennie Fleming Richards, 75, wife of **Walter A. Richards,** owner of the **Micro Products Company,** Chicago, passed away suddenly on February 29th at Chandler, Arizona. Funeral services were held in Chandler and interment services will be held in May at Joliet, Illinois.

Bridgeport Brass Appointments

Irving M. Malsch was recently named general sales manager of the **Bridgeport Brass Co.,** Bridgeport, Conn. and **John C. Miller** appointed sales manager, mills products. At the same time it was announced that **Col. Orson A. Kinney** had been appointed manager, defense sales and **Harry T. Jacobson** was named general traffic manager.

Made Technical Director at Carbide Firm

Edgar W. Engle has been appointed Technical Director of the **Vascoloy-Ramet Corp.,** Waukegan, Ill., producers of carbide wire drawing dies and other carbide products.

Firth-Loach Elects Chairman

Firth-Loach Metals, Inc., McKeesport, Pa., has announced the election of **M. A. Cancelliere** as Chairman of its Board, and **William J. Loach** to the new post of Executive Vice President.

★ ★ ★

Mr. Cancelliere is President of the First National Bank of McKeesport. Mr. Loach, a co-founder of the firm, was previously vice president and general manager.

★ ★ ★

The company manufactures a varied line of cemented carbides used in the metalworking and other industries.

Have You Read
"STEEL WIRE IN AMERICA?"
by Kenneth B. Lewis
The price is $15.00

CHECK LIST FOR
PLYMKRAFT
IMPROVED CABLE FILLER
Samples supplied upon request
Made to fine tolerance
Always uniform
Available in put up that works best on user's equipment
Takes any type treatment—wax, jute saturant, anthracene
Made to user's specifications if desired
Backed by the Plymouth Cordage Company, makers of quality products since 1824
Write to: PLYMKRAFT DIVISION
Plymouth Cordage Company
Plymouth, Mass. • New Orleans, La.
Warwick, Va.
PLYMOUTH
1824

Wire Reinforcement Institute to Meet in May

Frank B. Brown, Managing Director of the **Wire Reinforcement Institute** has announced that the Annual Spring Meeting of members and directors will be held on May 28-30, 1956, at the Greenbrier Hotel in White Sulphur Springs, West Virginia.

Aluminum Leaders Elect Officers at Association's Annual Meeting

Everett G. Fahlman, President, **Permold Co.,** Medina, Ohio, was re-elected President of **The Aluminum Association** at its annual meeting in New York in January.

★ ★ ★

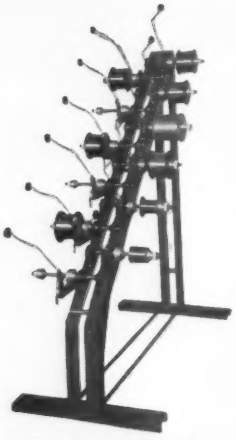
Arthur V. Davis, Chairman of the Board of the **Aluminum Company of America,** was re-elected Chairman of the Board. **Archie P. Cochran,** President, **Cochran Foil Co., Inc.,** Louisville, Ky., and **John W. Douglas,** President, **Republic Foil and Metal Mills Inc.,** Danbury, Conn., were re-elected directors-at-large to serve three-year terms and **C. A. Macfie,** President, **Revere Copper and Brass, Inc.,** New York, was elected to serve three years.

★ ★ ★

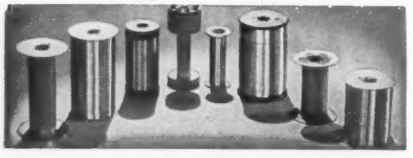
STANDARD UNI-DRIVE WIRE WINDER.

INCREASE YOUR PRODUCTION WITH THIS WINDER

Wire Winder



Pay-off Attachment



Various types of supply packages that may be wound on Standard Uni-Drive Wire Winder.

PAYOFF

Our payoff attachment is made with self-aligning ball bearings and a compensating attachment to control the tension of each end. Applies same tension when spool is empty as when full.

The new Uni-Drive Winder with Payoff Attachment is new in design and incorporates several improved and tested features. Production is stepped up through increased speed. It produces smooth, even and accurately wound spools of wire in single or multiple ends. All strands parallel—no over or under-winding. Automatic Stop-Motion controls each strand. Compensating attachment produces perfectly controlled tension. Traverse adjustable from 1¾" to 5½" between spool heads without changing cam. Designed especially for winding wire to be braided and shielded for electrical conductors up to ¾" diameter.

Payoff can be equipped with Carboloy Guide Inserts at additional cost.

STANDARD MILL SUPPLY COMPANY
PAWTUCKET, RHODE ISLAND, U.S.A.
1064-1080 Main St.
PAwtucket 3-1534 — 3-1535 — 3-1536

The following Association Vice Presidents were also re-elected: **L. M. Brile,** President, **Fairmont Aluminum Co.,** Fairmont, West Va.; **Frank B. Cuff, Aluminum Company of America,** New York; and **George N. Wright,** General Manager, **Harsch Bronze & Aluminum Foundry,** Cleveland, Ohio.

Norelco Opens Office in Newark

On January 1, the Research & Control Instruments Division, **North American Philips Company, Inc.,** 750 South Fulton Ave., Mount Vernon, N. Y. established a new office at 96 Bloomfield Avenue, Newark, New Jersey, it has been announced by **C. J. Woods,** National Sales Manager.

★ ★ ★

John O'Connor is district manager, **Frank Cavanaugh** is sales engineer and **Frank Stein** is service engineer. The new office will serve Norelco customers in New Jersey and eastern Pennsylvania, the territory formerly covered by the F. J. Mullowney X-ray Company of Trenton.

★ ★ ★

Edward Champaygne, Al Gobus and Joseph Ladd from headquarters have been assigned to assist with technical problems at the Newark office.

Joins Pacific Coast Borax in New York

Raymond M. Burke has recently joined the **Pacific Coast Borax Co.,** Division of Borax Consolidated, Limited. He will be located at the Company's New York office in their Technical Service and Product Development Department. His previous association was with the Research Division of General Foods Corporation. Mr. Burke graduated from St. Peter's College with a B. S. in Chemistry and is now completing work for his Master's Degree in Science at Stevens Institute with major in Marketing.

Bohn Appointment

Announcement has been made of the appointment of **M. R. Westover** to the post of assistant to the executive vice president of the **Bohn Aluminum & Brass Corp.,** Detroit, Mich.

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50¢ for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,733,563, METHOD OF CLEANING SCALED AND SOILED WIRES OR BANDS, patented February 7, 1956 by Rudolf Kaiser, Dusseldorf, Germany, assignor to Langbein-Pfanhauser Werke A. G., Dusseldorf, Germany.

A method of cleaning scaled and soiled wires or bands is disclosed which comprises first, electrolytically treating the wires or bands, and thereafter pulling them through a granular scouring substance composed of particles free to move relative to one another in any direction while simultaneously subjecting the substance to violent agitation in a manner that will cause an irregular continuously changing distribution of particles about the wire or band.

★ ★ ★

No. 2,733,734, FLEXIBLE AND EXTENSIBLE HOSE, patented February 7, 1956 by James H. Woodward and Leonard Myles, Manchester, England, assignors to Dunlop Tire and Rubber Corporation, Buffalo, N. Y., a corporation of New York.

Reinforced flexible and extensible hose is claimed which comprises a wire helix and an impermeable tube of fabric reinforced rubber formed about the turns of the helix and inwardly between these turns in a spiral fold.

★ ★ ★

No. 2,733,735, FORK GRIDS FOR LOOMS, patented February 7, 1956 by Sam L. Huffman and Richard J. Irwin, Greenville, S. C.

The grids are formed from a single section of wire which is bendable and will hold its shape when bent.

★ ★ ★

No. 2,735,114, SPRING ASSEMBLY, patented February 21, 1956 by Leland O. Collins, Detroit, Mich., assignor to L. A. Young Spring & Wire Corporation, Detroit, Mich., a corporation of Michigan.

This assembly comprises a frame member, base bars disposed in transversely spaced relation to each other and to said frame member and having longitudinally spaced upwardly projecting loops therein, and conical springs having arms extending from their bottom coils disposed on said base bars with their bottom coils embracing the loops thereof, the arms of the springs mounted on one base bar being inserted through the loops of an adjacent base bar and over the bottom coils of the springs arranged thereon for securing the springs to the base bars, the arms of the springs adjacent the frame member being secured thereto.

★ ★ ★

No. 2,735,454, METHOD AND A DEVICE FOR MAKING WIRE COILS, patented February 21, 1956 by John O. Forster, Harrison, N. Y., assignor to Heli-Coil Corporation, Danbury, Conn., a corporation of Delaware.

There are twelve claims to the method and the device for producing wire coils of a predetermined length by a continuously-operating wire coiling machine producing a spiral from a wire stock.

★ ★ ★

No. 2,736,346, COIL WINDING MACHINE, patented February 28, 1956 by Bernard W. Ammann, Northwoods, Mo., assignor to The Emerson Electric Manufacturing Company, St. Louis, Mo., a corporation of Missouri.

A wire coil machine is disclosed on which coils of a selectively predetermined number of steps and of a selectively predetermined number of turns per step are automatically wound. There are nine claims.

★ ★ ★

No. 2,736,699, COLD WORKING LUBRICANT FOR WIRE AND THE LIKE, patented February 28, 1956 by Richard L. Carhart, Lockport, Ill., assignor to United States Steel Corporation, a corporation of New Jersey.

A cold working lubricant for wire is claimed, comprising a mixture of from 8 to 35% water insoluble metal soap, from 20 to 80% of ferrous sulphate, ferric sulphate or a combination thereof,

DIADUST

The finest always costs a little more

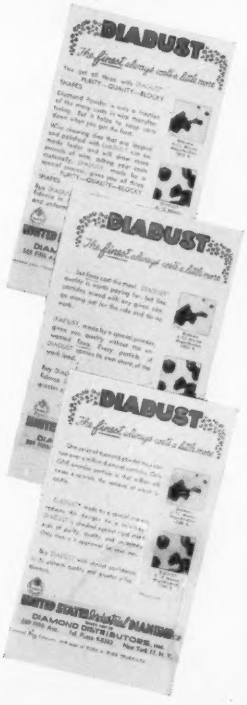
Some time ago we set out to prove that, in Diamond Powder, *quality* speaks for itself.

Ours is a simple story. The best in Diamond Powder means three things:

1. **PURITY—freedom from contamination.**
2. **QUALITY—uniform grading that never varies from one shipment to another.**
3. **SHAPE—blocky shapes with hard-cutting, long-lasting points.**

The best in Diamond Powder means DIADUST*.

We will continue to maintain these high standards always.



*Registered

MEMBER

UNITED STATES Industrial DIAMOND CORP.

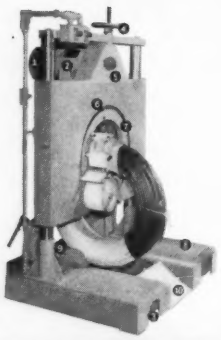
SALES MGT. BY

DIAMOND DISTRIBUTORS, INC.

589 Fifth Ave. Tel. PLaza 9-8383 New York 17, N. Y.

1 man can operate Angier's NEW UW-10 spiral wrapper . . .

These features make it the most versatile machine available

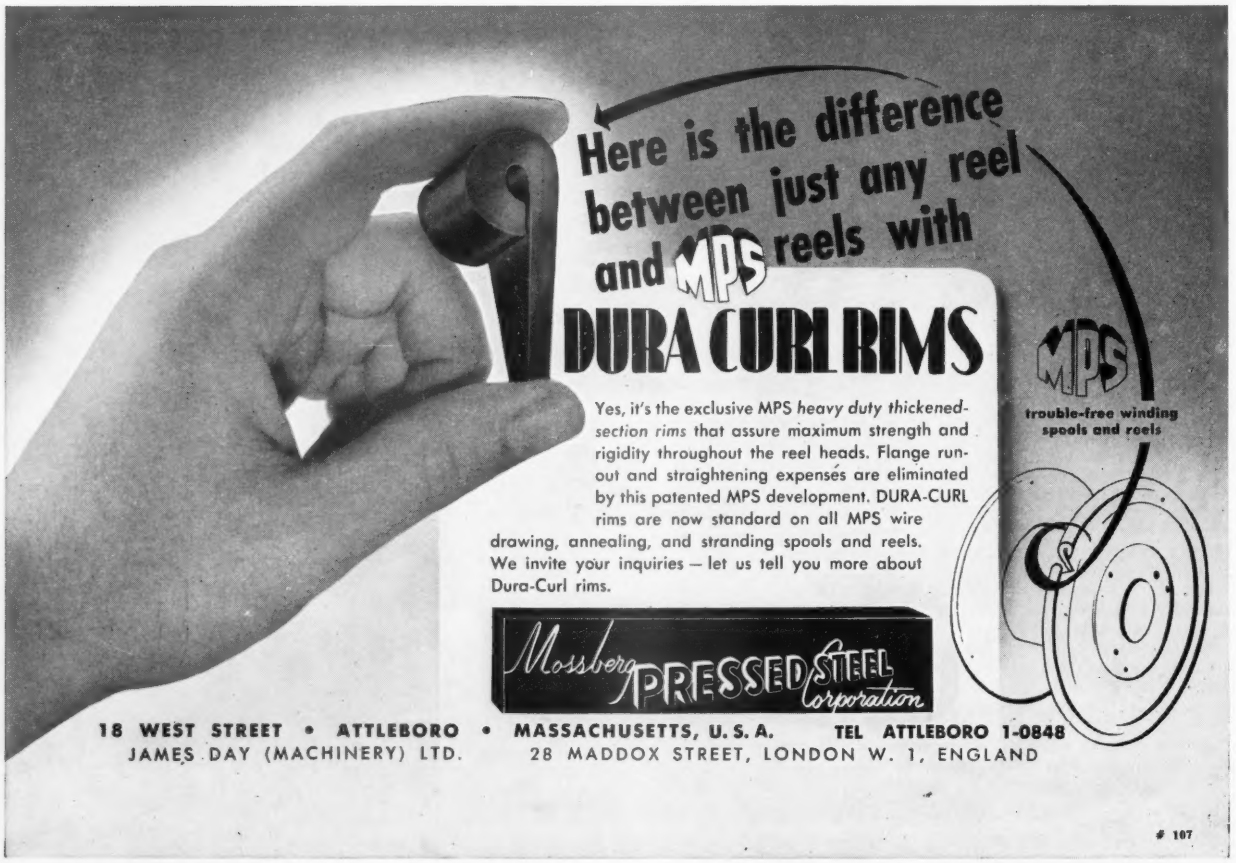


1. Automatic electric brake.
2. Direct connected high starting torque motor.
3. Shuttle jog control.
4. Vertical shuttle adjustment. (Power drive available)
5. V-Belt shuttle drive (concealed).
6. Ball-bearing shuttle rolls.
7. Forged steel shuttle.
8. Separate motor for feed roll drive (concealed).
9. Horizontal feed roll adjustment (both rolls).
10. Roll-in loading.

Angier Corporation, Framingham 3, Mass.

Angier

GET FACTS ON THE UW-10 AND OUR FULL LINE OF SPIRAL AND BAR PAPER WRAPS.


Here is the difference between just any reel and MPS reels with
DURA CURL RIMS
Yes, it's the exclusive MPS heavy duty thickened-section rims that assure maximum strength and rigidity throughout the reel heads. Flange run-out and straightening expenses are eliminated by this patented MPS development. DURA-CURL rims are now standard on all MPS wire drawing, annealing, and stranding spools and reels. We invite your inquiries — let us tell you more about Dura-Curl rims.
MPS
trouble-free winding spools and reels
Mossberg PRESSED STEEL Corporation
18 WEST STREET • ATTLEBORO • MASSACHUSETTS, U. S. A. TEL ATTLEBORO 1-0848
JAMES DAY (MACHINERY) LTD. 28 MADDOX STREET, LONDON W. 1, ENGLAND
107

each molecule of the ferrous sulphate and each molecule of the ferric sulphate having at least four molecules of water of crystallization and from 10 to 45% of a filler compound having a metal radical which is above ferric iron in the electromotive series and which will satisfy the sulphate radical of the ferrous sulphate and the sulphate radical of the ferric sulphate, this filler being substantially inert with respect to the wire and being a compound from the group consisting of the borates, silicates, phosphates, carbonates, chromates, hydroxides, oxides, and sulphides of metals which are above ferric iron in the electromotive series, the percentages being by weight.

★ ★ ★

No. 2,736,700, LUBRICANT FOR COLD DRAWING OF THORIUM WIRE, patented February 28, 1956 by Charles D. Graham, Jr., Birmington, England, and Raymond J. Donley, Elyria, Ohio, assignors to the United States of America, as represented by the United States Atomic Energy Commission.

A wire drawing is disclosed consisting essentially of a mixture of 2 to 5 parts by weight molybdenum disulfide and 1 part by weight of finely divided leaded zinc oxide suspended in a drying vehicle.

New Magnet Wire Spool Announced

The Hubbard Spool Company, Inc. has announced that it is now in production on a newly designed non-returnable type shipping reel for the Magnet Wire Industry.

★ ★ ★

The size now being offered has a 12" diameter flange x 6¼" diameter barrel by variable traverse and is constructed with a molded flange which incorporates good tensile and impact strength.

★ ★ ★

The barrel consists of a special heavy wall paper tube and, the entire reel is held together with either bolts or tubular rivets, according to the customer's preference.

★ ★ ★

The entire reel is moisture resistant and designed to carry 100 pounds of magnet wire. The molded flanges have a very smooth surface over which the wire can be taken off freely and, at high speed, requiring no change in the present wire mill manufacturing machinery or equipment.

★ ★ ★

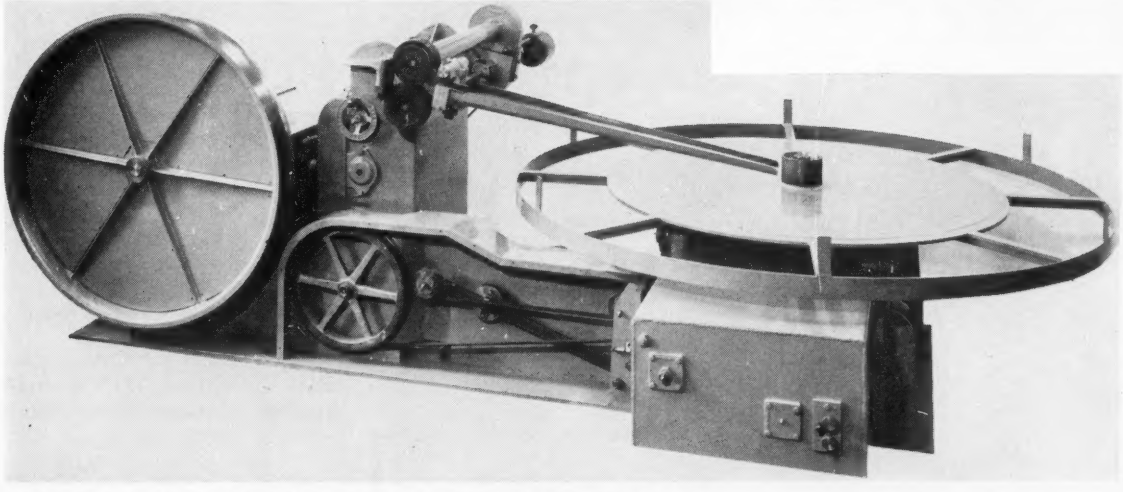
The new reel maintains the minimum weight variation, therefore, is very favorable for palletized shipments of magnet wire. This reel is attractive in appearance, as well as selling for a much lower price than the conventional returnable type reel.

★ ★ ★

The entire reel is constructed in a manner to save weight over the conventional reel which of course is attractive from the point of savings in freight costs. Hubbard Spool Company, Inc. is now in production on this item and will welcome inquiries from all potential users.

Furnace Manufacturer Expanding

Surface Combustion Corp., Toledo, Ohio, is constructing a new building adjacent to its present plant. The new facilities will increase productive capacity of the plant by about one-third. The expansion was planned to meet increased demand for the firm's industrial furnace equipment.



SINGLE TABLE PANNING MACHINE NO. 1149

Arranged to Accommodate 80" Diameter Pans.
Can be Built for Larger Pans.
Cut Shows 42" Diameter Capstan.
Wire Guide Spout is Stationary.
Table with Pan Traverses. Pan Table is provided with a Lock so that Table can be released for Hand Panning.
Can be Built as Shown or Opposite Hand.
Not Shown are the Main Variable Drive and also the Guard over the Traverse and Table Drive.

EST. 1855 AIMCO INC. 1915
"American" AIM INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
FAIRHILL AND HUNTINGDON STREETS
PHILADELPHIA 33 PENNSYLVANIA U.S.A.

New Electronic Micrometer Announced

At the inspection bench unskilled help can now check up to 3,500 pieces an hour at tolerances less than .0001" with the "Minitron" electronic micrometer. It is priced low and its laboratory caliber accuracy is guaranteed by the manufacturer throughout years of service.

★ ★ ★

It is an all-purpose shop gauge featuring two sets of adjustable anvils for accepting a production run for quick checking without "feel". This permits the gauge stand to be quickly preset and locked to conform to a master. The pieces, then, are simply inserted and the position of the indicator noted. Diameter, concentricity and taper are quickly found. It is indispensable for off balance or unwieldly pieces and provides positive time-cost reduction on all jobs.

★ ★ ★

The "Minitron" has an electronic adjustment which permits the establishment of any magnification desired from 10,000/1 to 1,000/1. When adjusted for largest magnification, .0001" appears over one full inch. A typical application would be job checking right next to a grinding machine. There is no flicker or drift of the gauging indicator. This is one of the many measurement and control devices offered by EAM Division of **Industrial Gauges Corporation,** 40 Grand Ave. Englewood, N. J.

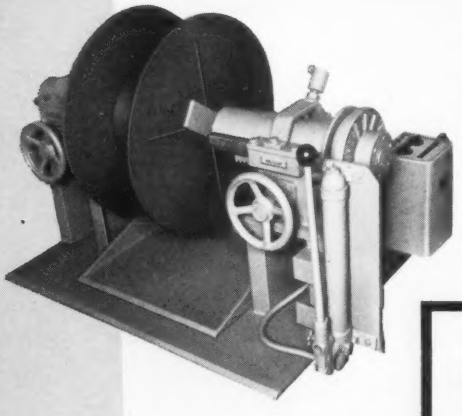
Think of WIM for:
Fast Action, Shaftless
PAYOFF STAND

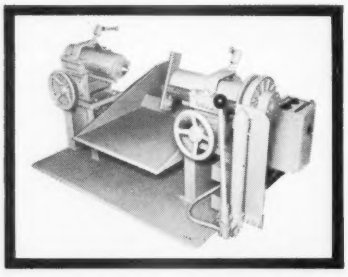
1. Electric Tension Control — dial operated.
2. Hydraulic Lift.
3. Ball-Bearing Mounted Spool Arbors.

New, modern—the WIM Model A Shaftless Payoff Stand—offers smooth, easy and continuous tension control; simple hydraulic lift loading; and faster action.

The unit will handle any spool size from 16" to 36" and up to 1000 lbs. total weight. Trouble-free operation is assured by ball bearing mounted spool arbors.

Think of WIM for the finest wire handling machinery.





WIM Model A Shaftless Payoff Stand
Write for complete details.

WIRE INSULATING MACHINERY INC.
DIVISION: MACHINERY ELECTRIFICATION, INC.
NORTHBORO, MASS. 35 HUDSON STREET

New Metals Directory Published in Belgium

The Association of Non-Ferrous Metals Industries, 7 Joseph II Street, Brussels, Belgium, has published a "Survey of the Belgian Non-Ferrous Metals Industry" giving lists of members and products.

★ ★ ★

In the one volume the information is printed in French, German, Dutch, Spanish and English, covering virgin metals, semi-finished products, chemicals and miscellaneous other products. The list of members is arranged alphabetically, with their principal fabrications following each name.

★ ★ ★

Metals covered are aluminum, antimony, silver, bismuth, cadmium, cobalt, copper, tin, germanium, nickel, gold, palladium, platinum, lead, selenium, tantalum-niobium, uranium and zinc.

Industrial Furnace Industry Off to Good Start

The Industrial Heating Equipment Industry is off to a fast start in '56, according to industry figures cited by **Carl L. Ipsen,** Executive Vice President of the **Industrial Heating Equipment Association.**

★ ★ ★

Orders received by member companies for industrial furnaces for January, 1956, were $10,244,066, a 106% increase over orders of $4,973,088 for January, 1955.

★ ★ ★

Orders received for induction and dielectric heating equipment also showed a healthy increase over those of a year ago. The figure for January, 1956 is $1,221,339 as compared with $1,031,104 for a year ago, an increase of 19%.

New Tachometer has Overspeed and Underspeed Controls

A new Metron tachometer not only indicates speed, but actuates self-contained power relays that signal overspeeds and underspeeds. Ideal for use in sounding alarms, turning on light signals, stopping or starting equipment, opening or closing valves, controlling speeds or for many other similar applications.

★ ★ ★

High and low limit pointers are independently adjustable. These pointers act as a single-pole double throw switch with the regular speed pointer acting as the switch

Metron Tachometer

center arm. A manual reset push button is used to reset the tachometer after the relays have signalled a high or low speed.

★ ★ ★

This tachometer is available with any one of 48 different scales—marked in any rate such as RPM, FPM or Sheets/Hour. For further information, write Metron Instrument Co., 432 Lincoln St., Denver 3, Colo.

★ ★ ★

Bakelite Reduces Prices

A substantial vinyl resin price reduction is announced by **Bakelite Company, a Division of Union Carbide and Carbon Corporation.**

★ ★ ★

"Effective January 9, 1956, vinyl resin prices have been reduced from 8.5 to 13 per cent, depending on the type," according to **George C. Miller,** President.

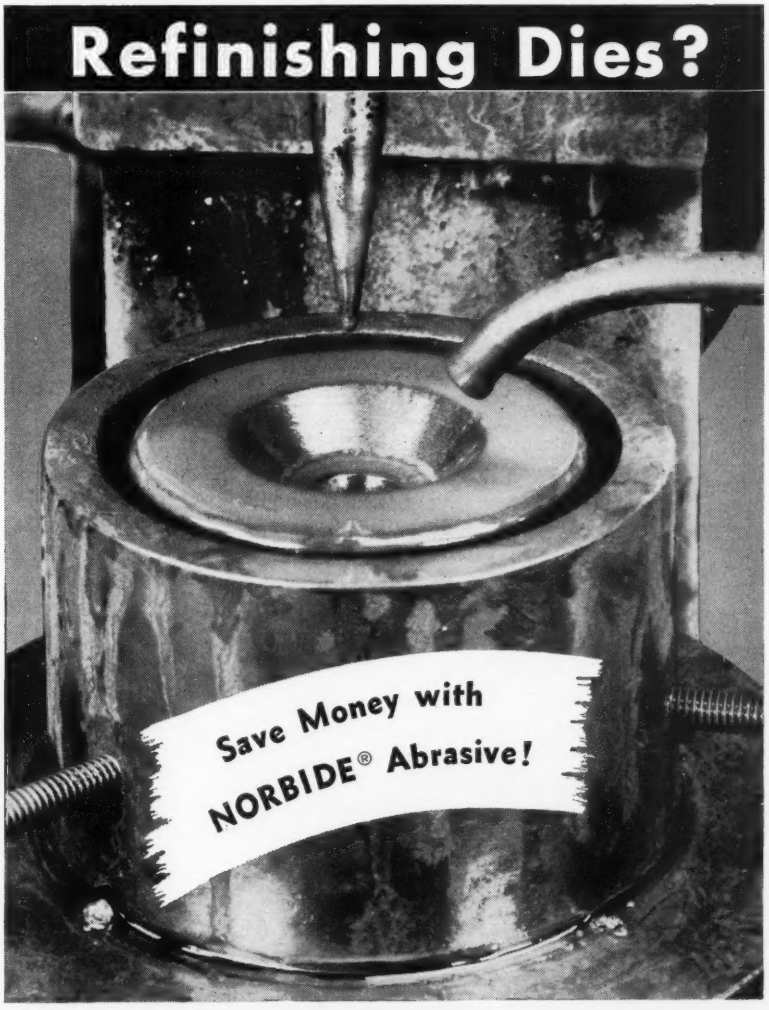
★ ★ ★

Polyvinyl chloride type resins, of which the Bakelite's grade designated VYNW is typical, are reduced from 31 cents to 27 cents per pound, and the vinyl chloride-acetate copolymer VYHH is reduced from 35 cents to 32 cents per pound. VYNW type resins have for many years been the base materials used in compounds for many applications such as wire and cable insulation.

★ ★ ★

Many Bakelite vinyl resin compounds will be reduced comparably, according to Mr. Miller.

Join the WIRE ASSOCIATION and work with others to improve the industry. Send for booklet.



You may never use a wire drawing die this large, but no matter what size dies you're refinishing, you can save money by using NORBIDE Abrasive — rather than costly diamond dust — for ripping or fast stock removal as well as for accurate semi-finishing operations. For details, write for Form 559.

NORTON
BORON CARBIDE

NORTON COMPANY
New Bond Street
Worcester 6, Mass.

CAMDEN WIRE CO., INC.

Wire Fabricators

Producers of Quality Fine Wire Copper Conductors

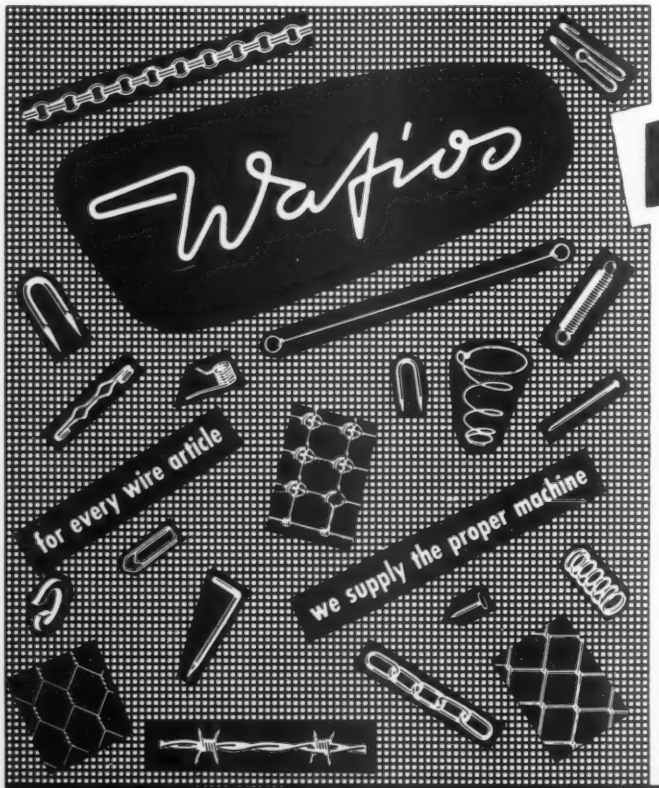
EXTRA FLEXIBLE CONDUCTOR STRANDED OR BRAIDED

MULTIPLE ENDS OF SIZES .008 to .002

BARE · TIN or LEAD COATED · SILVER PLATED

Special Heavy Tinned Conductors for Hook-up Wire

40 MASONIC AVENUE • **CAMDEN, NEW YORK**



AUTOMATICS

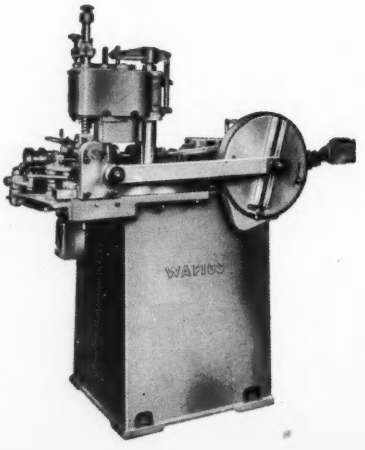
FOR THE WIRE TRADE

AUTOMATIC TORSION SPRING COILING MACHINE

Model SFM,
4 different sizes

Wire Range:
.008—.315"

Sole Agents for the U.S.A.
Kurt Orban Co., Inc.
34 Exchange Place,
Jersey City 2, N. J.



WAFIOS MASCHINENFABRIK REUTLINGEN 3 / GERMANY

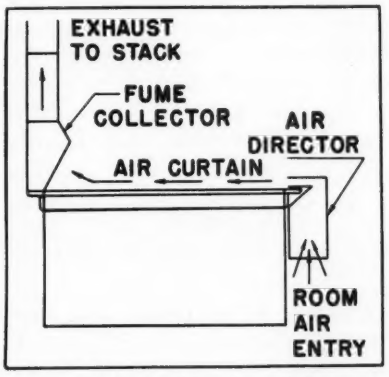
Fume Removal System

A new pre-engineered "Air-Saver" Fume Removal System (push-pull type) provides many design and cost advantages in ventilating, plating, anodizing and pickling tanks. The system consists of a collector or exhaust hood for removing fumes, and a director for supplying a current of air at proper velocity to direct the fumes into the collector hood. The director, a compact air supply unit, containing its own motor and blower, will furnish an even air current across a tank surface so that tanks as wide as six feet can be properly ventilated.

★ ★ ★

This system will save heat, as fume removal rates can be reduced up to 75%, thereby minimizing room heat losses. Savings in power are effected if smaller fans are required and reduced initial costs are obtained, since smaller ducts and stacks can easily handle reduced volume of fumes to be removed.

The systems are available in either solid Rigidon plastic, steel, or steel lined or coated construction. They are easy to install, and are supplied in pre-engineered standard sizes, with up-draft or down-draft collector hoods. Complete package units will afford the best fume removal system for new installations. In present installations, where hoods are not functioning as desired, or required, the addition of an Air-Director will improve the ventilating conditions.



Heil "Air-Saver" Fume Removal System.

For additional information, write **Heil Process Equipment Corp.,** 12901 Elmwood Avenue, Cleveland 11, Ohio.

AS&W To Build Fabric Mill

American Steel & Wire Division will begin construction in March of a new welded wire fabric mill which will add up to 40,000 tons of finishing capacity annually to its Cuyahoga Works it was announced today by **Harry L. Jenter,** district manager of operations for this division of United States Steel Corp.

★ ★ ★

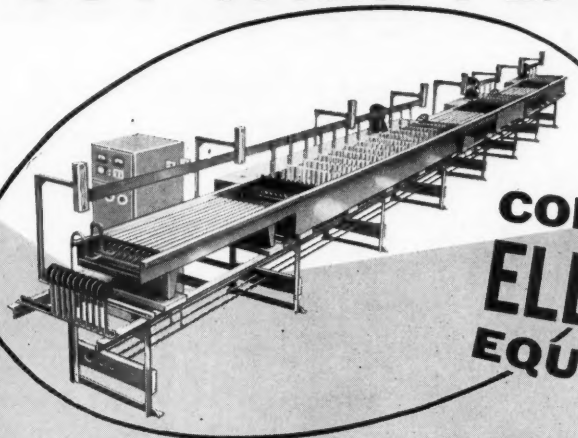
The new plant which will cover almost 53,000 square feet is being built in Cleveland to supply the need for the welded fabric which is used extensively in highway construction, building walls, floors and roofs, concrete pipe and private driveways.

★ ★ ★

It is part of American Steel & Wire's expansion for this popular construction steel. New facilities for its manufacture recently have been installed in its Joliet and Duluth plants.

CUT WIRE PLATING COST!

maintain uniformity on copper and aluminum wire



CONTINUOUS U.I.E.C. ELECTROPLATING EQUIPMENT

This low cost equipment performs uniform high quality work at speeds that mean real savings. Simple to operate. We furnish complete installation.

Write today to:

UNIVERSAL INDUSTRIAL EQUIPMENT CO.

SECAUCUS, NEW JERSEY

Sole agent in Canada: E. V. LARSON CO., LTD., TORONTO, CANADA

COPPER STATISTICS

COPPER - Refined copper produced at primary plants from domestic and foreign ores and from secondary material, 1946-50 (average) and 1951-55, in short tons

Year	Domestic ores	Foreign ores	Total new copper	Secondary	
				New	Old
1946-50 (average)	792,686	270,082	1,062,768	100,600	103,834
1951	951,559	255,429	1,206,988	83,021	52,002
1952	923,192	254,504	1,177,696	85,470	36,906
1953	932,232	360,885	1,293,117	109,974	79,611
1954	841,717	370,202	1,211,919	102,216	77,727
1955	1,000,000	340,000	1,340,000	131,000	75,000

Of the total of 1,546,000 tons of primary and secondary copper produced at primary refineries in 1955 (1,391,862 tons in 1954), 1,401,000 tons were electrolytic (1,287,938 tons in 1954), and 145,000 tons (103,924 in 1954) were Lake or other fire refined.

Booklet on Keystone's Cold Heading Wire

A new 12 page booklet describes the basic open hearth wire manufactured by the **Keystone Steel & Wire Co.**, Peoria 7, Ill.

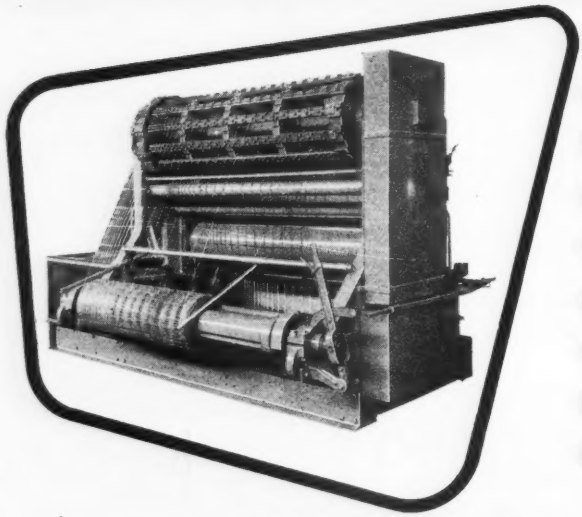
These wires come in grades suitable for cold heading work, spring forming and specialty applications. Various grades are listed with the advantages, limitations and design factors of each.

★ ★ ★

The booklet is copiously illustrated and contains much valuable information for wire product formers. Please write the company asking for No. 1a/Ke.

★ ★ ★

Interlocking FENCE LOOMS



- Fastest — Most Efficient
- Preferred by Leading Mills
- Low Maintenance Cost
- Wrapped Stay Fence
- Straight Stay Wires
- Integrated — Space Saving
- Replaceable Main Bearings
- Single or Double Strands
- Years of Low Cost Production

Write for Detailed Information — Without Obligation

Interlocking Fence Co., Box 8, Morton, Ill.

Specialists In Fence Looms

STEEL STATISTICS

AMERICAN IRON AND STEEL INSTITUTE
350 FIFTH AVENUE, NEW YORK 1, N. Y.

AIS 10

Total Number of Companies Included 131

JANUARY - 1956
Month

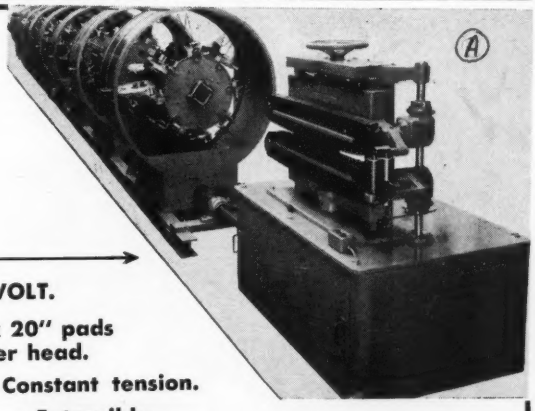
SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

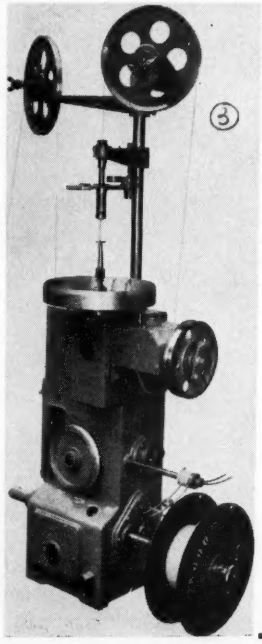
Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

Steel Products	Items	Current Month 1956 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1955) Percent of Total Shipments	Year to Date 1956 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1955) Percent of Total Shipments
Ingots and Steel Castings	1A	51,008	15,677	2,163	68,848	0.9	0.5						
Blooms, slabs, billets, sheet bars	1B	172,095	54,247	2,263	228,605	3.0	2.9						
Tube rounds	1C	-13	329	-	316	-	-						
Skelp	2	14,013	-	-	14,013	0.2	0.1						
Wire rods	3	102,150	2,334	389	104,873	1.4	1.4						
Total Semi-Finished		339,253	72,587	4,815	416,655	5.5	4.9						
Bars—Hot rolled (incl. light shapes)	14	602,923	210,453	4,587	817,963	10.8	10.4						
Bars—Reinforcing	15	181,906	-	-	181,906	2.4	1.9						
Bars—Cold finished	16	142,127	30,618	5,303	178,048	2.4	2.3						
Tool steel	17	1,567	9,546	-	11,113	0.1	0.1						
Total Bars and Tool Steel		928,523	250,617	9,890	1,189,030	15.7	14.7						
Wire—Drawn	23	260,364	4,446	3,219	268,029	3.5	3.6						
Wire—Nails & staples	24	50,091	-	-	50,091	0.7	0.8						
Wire—Barbed & twisted	25	7,148	-	-	7,148	0.1	0.2						
Wire—Woven wire fence	26	24,956	-	-	24,956	0.3	0.5						
Wire—Bale ties	27	3,051	-	-	3,051	-	-						
Total Wire & Wire Products		345,610	4,446	3,219	353,275	4.6	5.1						
Strip—Hot rolled	37	165,506	3,237	314	169,057	2.2	2.6						
Strip—Cold rolled	38	141,201	1,458	24,105	166,764	2.2	2.2						
Total Sheets and Strip		2,704,786	111,532	39,069	2,855,387	37.6	41.9						
Total Shipments (1956)		6,970,755	555,969	61,146	7,587,870	100.0	xxx						xxx
Total — Prior Year (1955)		5,559,074	402,745	48,139	6,009,958	xxx	100.0					xxx	

NEW...

IN PAPER LAPPING





FOR TELEPHONE
— High speed paper lapping.
— 3,000 r.p.m.
— Movable drum.
— Automatic stop.
— 12" pad.
— Electric counter.
— Central lubrication.

FOR HI. VOLT.
— 8 x 20" pads per head.
— Constant tension.
— Extensible pad centre.
— Individually braked.
— Variable die.
— Caterpillar haul-off.
— P.I.V. drive.
— Automatic stop.

POURTIER MACHINES
153, rue Général Gallieni
ROMAINVILLE (Seine) FRANCE

Republic Buys Into Titanium Firm

The Crane Company and the **Republic Steel Corporation** announced negotiations for the purchase by Republic of one half of Crane's interest in **Cramet, Inc.**, a producer of titanium sponge, with a plant at Chattanooga, Tenn. Cramet is now a wholly-owned subsidiary of Crane.

★ ★ ★

In 1953, Cramet was awarded a contract by the Government calling for yearly production of 6,000 tons of titanium sponge over a five-year period. Cramet received an advance of nearly $25,000,000 from the Government for construction of a production plant at Chattanooga, Tenn. The plant began operation in January 1955.

★ ★ ★

Republic began commercial production of titanium ingot, plate, sheet, strip and bar shapes in 1952.

New 1 Ton Air-Press

This bench mounted high speed air press designed for spring manufacturing including Looping, Bending, Forming, Coiling and Pressing can also be used in other industries for light Punching, Trimming. Cutting, Crimping and other secondary operations. It replaces bulky slow moving kick-presses and provides a fast easy method for

increasing production up to 50% and reducing manufacturing costs. Over 1800 loops and 3000 punches per hour have been made.

★ ★ ★

The press comes ready to use with bolster plate, foot switch, solenoid valves, electrical fittings and air line connections. An adjustable screw stop controls the stroke of the ram up to 2 in. and ram speed is controlled by a valve on the air line. Size of frame is 8 in. wide, 11 in. deep and 22 in. high overall. Net Weight 115 lbs. Bulletin available from **The Carlson Co.**, 277 Broadway, New York 7, N. Y.

New Folder Describes Haskell-Dawes' Two Head Twisters-Formers

Haskell-Dawes Machine Co., Inc., 2231 E. Ontario St., Philadelphia 34, Pa., has issued a bulletin describing the latest models of their two head 8x10 . 12x14 Twisters and Formers.

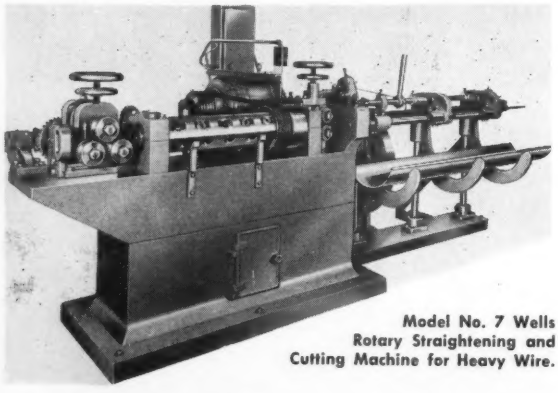
★ ★ ★

The mechanical features are described in detail and information is given on accessory equipment, such as counters, shears, creels and electric stop motions. Full specifications are given in a chart and

A Fast, Dependable Wells

STRAIGHTENER AND CUTTER FOR HEAVY WIRE

Shown below is the famous Model No. 7 WELLS ROTARY STRAIGHTENING AND CUTTING MACHINE designed for a maximum of durability and service.



Model No. 7 Wells Rotary Straightening and Cutting Machine for Heavy Wire.

Flyer runs in ball bearings. All wear parts made of tough steel for long, trouble-free operation.

Motor and gears are readily accessible.

A highly satisfactory machine for day-in, day-out production.

This machine is designed to handle 1/4", 5/16", 3/8", 7/16" and 1/2" wire at speeds of 90' to 100' on long continuous production runs. Other WELLS MACHINES are made to handle smaller gauges of wire at correspondingly higher speeds.

Backed by 59 years of experience and development

Send for Catalog covering the full line.

Frank L. Wells Company

KENOSHA • 5821 Fifth Avenue • WISCONSIN

Builders of Fine Wire Working Machinery

the several models are illustrated.

★ ★ ★

Copies of the folder may be secured by writing the company.

Elevated Temperature Properties of Carbon Steels

This is the fourth publication in a current series prepared under the auspices of the ASTM-ASME Joint Committee on the Effect of Temperature on the Elevated Temperature Properties of Metals. This series was started so as to incorporate in one book the available elevated temperature data on a particular "family" of metals.

★ ★ ★

This "carbon steel compilation" includes data for tensile and yield strength, elongation and reduction of area, stresses for creep rates of 0.0001 and 0.00001 per cent per hour and rupture strengths for 100, 1,000, 10,000 and 100,000 hours.

★ ★ ★

The steels covered are killed carbon steel (0.18 to 0.24 C), ASTM A 201 Grade B plant steel (0.24 C max), ASTM A 106 Grade B pipe steel (0.30 C max), killed carbon steel (0.27 to 0.58 C), aluminum killed steel, open steel (rimmed or capped, and miscellaneous carbon steels (limited data available.)

★ ★ ★

The previous reports include Elevated Temperature Properties of Stainless Steels (ASTM STP No. 124), Elevated Temperature Properties of Chromium Molybdenum Steels (ASTM STP No. 151), and Elevated Temperature Properties of Selected Super-Strength Alloys (ASTM STP No. 160).

★ ★ ★

Copies of this 68 page book can be obtained from ASTM Headquarters, 1916 Race Street, Philadelphia 3, Pa., at $3.75 per copy.

Booklet on Diamond Wheel Salvage

A new booklet describing the benefits of collecting swarf from diamond wheel grinding operations and salvaging the worn out diamond wheel stubs is available from **Norton Company,** Worcester 6, Mass. This booklet includes such information as where swarf can be sent for reclamation, value of diamonds salvaged (up to $1.70 per carat), and types of swarf which are acceptable for salvage. Copies will be sent free on request.

Method X Tool Sharpener

Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa., has released a new bulletin on the Method X Tool Sharpener, detailing specifications, case histories and methods of use of this maintenance implement.

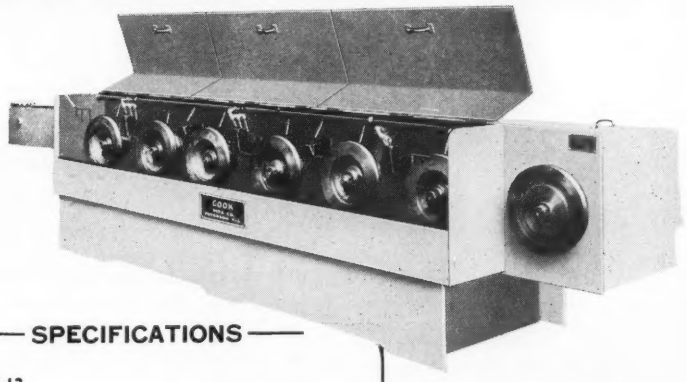
★ ★ ★

The bulletin is available for immediate distribution.

Laclede Steel Opens Detroit Office

Laclede Steel Company, St. Louis, Mo., has announced the opening of a Detroit office at 320 Stephenson Building — with S. Tucker Gay in charge.

Heavy Duty Rod Breakdown Machine



SPECIFICATIONS

MODEL D-13

Maximum size of Entering Rod	5/16" Copper, 3/8" Aluminum
Finished Wire Size	#8 to #16 B&S Gauge
Maximum Operating Speed	3,200 ft./minute
Maximum Number of Dies	13
Number of Drawing Blocks	6
Maximum Size of Die Case	1½" dia. x 1" thick
Spool Capacity	1,000 lbs.
Spool Traverse	11"
Spool Diameter	30"
Motor Size (maximum)	200 HP

MODEL D-17

Maximum Size of Entering Rod	5/16" Copper, 3/8" Aluminum
Finished Wire Size	#8 to #19 B&S Gauge
Maximum Operating Speed	5000 ft./minute
Maximum Number of Dies	17
Number of Drawing Blocks	8
Maximum Size of Die Case	1½" dia. x 1" thick
Spool Capacity	1,000 lbs.
Spool Traverse	11"
Spool Diameter	30"
Motor Size	150 HP

- **HIGH PRODUCTION**
- **LOW INITIAL COST**
- **LONG SERVICE LIFE**
- **LOW MAINTENANCE**

The drawing and idle capstans are provided with easily replaceable, heat-treated steel bands. All drawing block shafts are of high grade alloy steel. Power is transmitted through the machine by means of heavy duty pre-stretched chain and hardened steel sprockets. All rotating members are supported on the highest grade ball bearing enclosed within the main drive housing and lubricated by means of a forced feed system. Standard equipment on all Cook Breakdown Machines includes full length jog pedal, main motor drive coupling and broken wire stop switch.

A Complete Line of Quality Machinery For The Wire and Cable Industry To Meet Rigid Specifications.

COOK MANUFACTURING CO.

50 EAST 25TH STREET, PATERSON, N. J. • ARMORY 4-6380

A MODERN
Hans C. Bick
LUBRICANT
SERVICE FOR
TOP OUTPUT
IN
CUTTING
GRINDING
STAMPING
DRAWING

• The top production rates designed into your machines are yours to profit by when you call upon Hans C. Bick for modern lubricants, coolants, and cutting fluids. Manufactured by specialists with 23 years' experience, these compounds are engineered for rigorous conditions such as high feeds, speeds and pressures. Furthermore, you'll like the friendly manner in which our engineers cooperate to solve the toughest problems. To get the most from your machines and tools, always call upon Hans C. Bick to smooth and cool the way.

Hans C. Bick, INC.
READING, PENNSYLVANIA

Mechanical Descaling of Wire Rod

(*Continued from page 425*)

did not remove the cuttings completely from the nail. This fault could have been traced to insufficient cleaning from scale.

★ ★ ★

The mechanically descaled wire could easily be further drawn down to fine dimensions, as far as to 0.031 inch (No. 21 or 22 gauge), without intermediate heat treatment. Success was not obtained however if the wire from the final draft was led over a fixed coiler. The straightening rolls had a definite visible effect of breaking and flaking off the film of lubricant so that for further drawing a uniform film (and in part any lubricant) was lacking.

Mechanical Arrangement of the Descaler

The kinds and operation methods of bending-descaling machines are quite numerous. They differ greatly in the number of rolls, as these run from three to twelve. The smaller the number, the greater is the angle of grip of the wire about the separate rolls and the greater is the descaling action. Machines differ especially in their arrangements for subsequent cleaning. Revolving sets of brushes about the rod, leading the wire through one or more pads of steel turnings, wood or leather scraps, or through fixed or revolving containers filled with casting scrap are means for ridding the rod of the vestiges of scale by abrasion. Particularly to be noted are electrical or mechanical arrangements for setting the rod in oscillation so that scale remnants are shaken off.

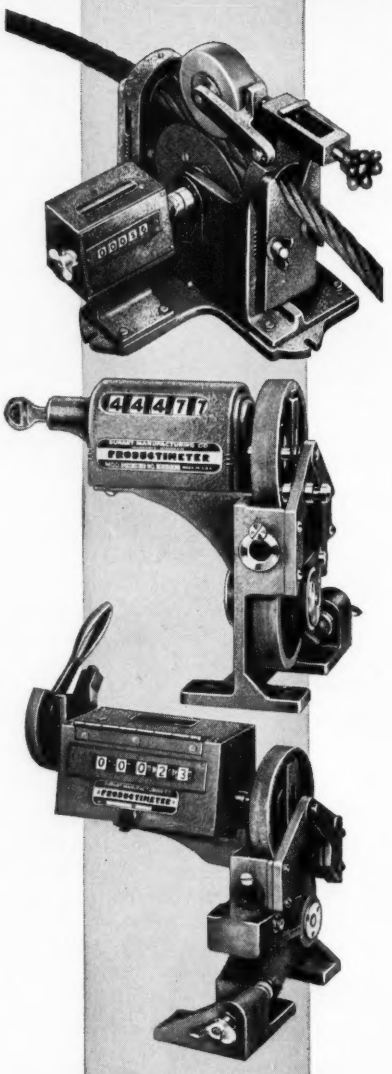
★ ★ ★

In these researches a machine with many rollers and cleaning by casting scrap was used as was also a three-roll machine and cleaning by steel wool. For use in mass production the following specifications for the machine should be followed:

Specifications for the Descaler

1. The machine should be compact, since it is an addition to

PRODUCTIMETER
WIRE MEASURING MACHINES
Fast . . Accurate . . Dependable . . Legible



Productimeters measure all types of wire from .010 to 1½ inches in diameter . . . at speeds up to 5,000 feet per minute. They eliminate "guess-work". . . insure profitable operation in your plant.

Send for Catalog No. 40

DURANT MFG. CO.
1918 N. Buffum St. Milwaukee 1, Wis.
118 S. Water St. Providence 3, R. I.
Representatives in Principal Cities

PRODUCTIMETERS
SINCE 1879 *Count Everything*

CUT
Die Room
COSTS
50%
with the New
type "M"

DYKREX
"IT CORRECTS THE DIE"

automatic
Polishing Machine

Double your finished Tungsten Carbide Die production

•

Save ½ labor costs—

•

The new automatic polisher with the Time Switch—

•

It is completely assembled—just plug it in!

ROOS TOOL & MFG. DIVISION
Dykrex Corporation of America
manufacturers of
Wire Die Finishing Machinery

33 Bloomfield Avenue
Newark 4, N. J.

Western Union
Teletype Service
QAB-WUX—Montclair, N. J.

The Standard of the Wire Industry

existing machines and must therefore fit into already restricted space.

★ ★ ★

2. Its construction must be simple and strong, as the wear and fouling are considerable.

★ ★ ★

3. The angle of grip should be adjustable to the rod diameter in order to descale sufficiently the rod of small dimension and avoid too great a strain in heavier rod.

★ ★ ★

4. The rolls must have a surface suited to the rod diameter so that the wire is properly guided. Smooth rolls are more subject to wear through the sidewise movement of the rod.

★ ★ ★

5. The arrangement of the rolls must permit an easy insertion of the rod, considering that the coils cannot always be welded together so that each coil may have to be newly inserted.

★ ★ ★

6. The machines must be completely enclosed so that operators shall not be bothered by scale dust and to avoid danger from neighboring machines.

★ ★ ★

For the drawing frames, more than formerly it becomes imperative that the here necessary guide rollers have a large diameter, so that the film of lubricant may not be torn and sheared off by too small a radius of bend. Gliding friction on the rod must particularly be avoided.

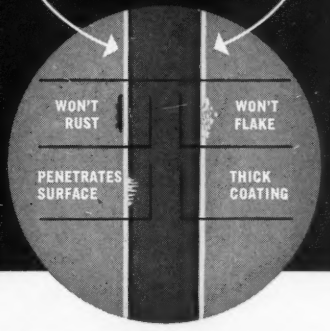
Outlook for Mechanical Descaling

The mechanical bending-descaling is already currently in use in numerous plants, especially where the wire is relatively little worked by a limited number of drafts or where no great emphasis is placed upon the surface condition. In many other plants it is being carefully tested to determine the range of its usefulness. Because of its anticipated economical advantage it is getting a strong boost.

★ ★ ★

Here's why you should coat high and low carbon steel rod with

BORAX
5 MOL.



No Dust... For a cleaner shop—pleasant working conditions and easier house keeping. Borax-coated rod does not dust or flake, can be held in storage longer and is pleasanter to handle.

No Baking... The Borax solution penetrates the porous surface of the metal, neutralizing deepseated acid, and eliminating the need for baking.

Longer Storage... The continuous film of Borax inhibits the formation of rust for a considerable period—particularly important where several days may elapse between coating and drawing.

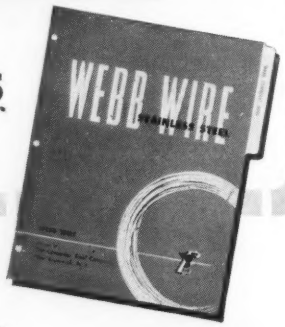
Economical... A single dip in the Borax bath provides a thick durable coating which is very valuable where the wire is to be drawn in several stages.

Write to our Technical Department for further information.

PACIFIC COAST BORAX CO.
DIVISION OF BORAX CONSOLIDATED, LIMITED
NEW YORK • CHICAGO
LOS ANGELES • CLEVELAND
PHILADELPHIA

MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS

NEW INFORMATION ON STAINLESS WIRE



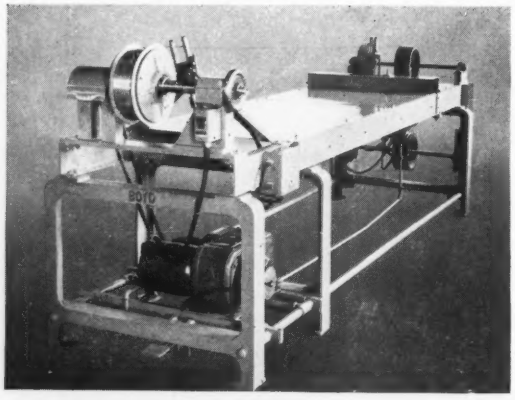
for:
springs
wire forms
surgical instruments
piston rings • ball bearings
decorative parts • fishing leaders
shafts • pivots • pins • *and many others!*

• Where quality and uniformity count . . . work with WEBB for your stainless wire needs. More and more manufacturers are finding that WEBB Wire *works* where others won't. New data sheet gives full information on applications, sizes and properties of WEBB Stainless Wire. Write for a copy.

The Carpenter Steel Company
WEBB WIRE DIVISION
New Brunswick, N.J.

"IT'S HERE" . . .

The Boyd Micro-Spooler



Now you can get a perfect level layer wind on aluminum, stainless steel, bronze and all other types of welding wire in the complete diameter range.

The BOYD MICRO-SPOOLER (U. S. Patent #2862 filed Oct. 5th, 1954) is simple in operation. It requires no change gears. It operates at speeds up to 900 feet per minute. The perfect level layer wind will improve the operation of all metal inert gas shielded arc welding procedures.

A free demonstration is available. Send or bring a sample of your welding wire in a size down to 1/32". We will wind it on your spools or ours with a perfect level layer wind. Your engineers may witness the operation if you wish.

BOYD & SONS MANUFACTURING CORPORATION
1434-38 Callowhill St. **Philadelphia 30, Pa.**

It is not yet adaptable to the whole field of wire production. Much remains to be done in order to ensure completely satisfactory working methods and the demanded quality of product. But all parties concerned—wire manufacturers, makers of descaling machines and producers of lubricants—are aware of the importance of this problem and their cooperative attack upon it will probably bring early some satisfactory solution.

A User's View of Plastic Insulated Conductors in Outside Telephone Plant

(*Continued from page* 431)

Video Pairs

There is another application of polyethylene insulation to conductors in the telephone plant which may be unfamiliar to many. The mileage of such conductors is by comparison small but the importance of polyethylene is great. We refer to a cable pair for use in establishing local television channels; for example, between the telephone office and a program pick-up point such as a theater or a sports stadium or between telephone offices in a multi-office city like Detroit where a network of these circuits is required.

★ ★ ★

These pairs have 16 gauge copper conductors insulated with expanded polyethylene. Glass reinforced polyethylene string spacers are employed to provide a cross section suitable for wrapping with a polyethylene tape. Shielding is afforded by an inner longitudinal copper tape and an outer spiral copper tape. An overall paper wrap bound with string completes the make-up of the pair.

★ ★ ★

The attenuation of these video pairs is 18 db per mile at 4 mc which may be compared to 36 db for paper insulated pairs. Expressed in other terms, if we assume an allowable loss of 63 db, the repeater spacing for polyethylene insulated pairs is 3.5 miles and for paper insulation 1.75 miles.

Summary

To summarize, as a user of plastic insulated conductors in outside telephone plant, we have used such insulation in toll cable, exchange cable, rural wire, urban wire and video pairs. Two of these applications would be outside the realm of practicability with other known insulating materials, specifically, Rural Wire and Urban Wire.

★ ★ ★

In the toll cable plant for carrier operation, it provides a facility with lower average transmission losses and less pair to pair variation, therefore, the resulting system is less susceptible to noise and employs longer length repeater sections. It is less susceptible to lightning damage and since the insulation does not absorb moisture it provides greater service reliability even without the application of continuous gas pressure.

★ ★ ★

In the case of inter-office trunk cables in multi-office exchanges and trunk cables to remote community dial offices we again realize the greater reliability because of freedom from moisture trouble; in the case of longer haul cables which may carry subscriber pairs much greater freedom from lightning trouble.

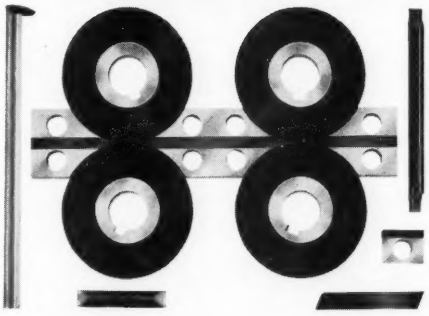
★ ★ ★

In rural applications it affords a more trouble-free facility from lightning and moisture. In these areas lightning exposure is generally more significant than in the relatively shielded urban situation and while moisture protection is important in urban plant from the standpoint of number and character of circuits involved, it is equally important in rural plant because of the remoteness of rural cables from the headquarters of repair forces.

★ ★ ★

For special circuit application, all of the foregoing benefits again make the use of plastic insulation desirable. It is of some interest to note an application in this category which has not been previously touched upon. We are

CRAFTS ... for LONGER LIFE



Spring coiling machine tools made of tungsten carbide will outlast steel — but unless the grooves FIT your wire ALL AROUND — you are *not* getting *maximum* life.

CRAFTS Carbide Tools are optically ground in special equipment of exclusive design. Grooves are *guaranteed* round and to size . . . to give *complete* support and uniform wear for longest life.

Depend on **CRAFTS** Tools for better springs . . . a quality name since 1928.

MAIL COUPON TODAY

for Complete Information and Price List on the CRAFTS *line*

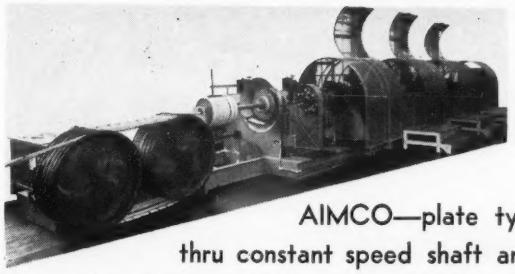
Arthur A. CRAFTS Company
601 Newbury Street
Boston, Mass.
CHICAGO DETROIT PHILADELPHIA BRISTOL, CONN.

Arthur A. CRAFTS Company, Inc.
601 Newbury Street, Boston, Mass.

Gentlemen:
Please send me complete information and Price List on CRAFTS Tools.

Name_____
Firm_____
Address_____

4-WIRE TWISTING MACHINES



CABLE REELS 48" DIA.-31" O.A. WIDTH.

FILLERHEAD 24 PACKAGES 12" DIA., 12" TRAVERSE.

AIMCO—plate type serving head driven thru constant speed shaft and variable speed drive. Taping head 24" pad driven thru constant speed shaft and variable speed drive.

Capstans double 6 groove 42" root diameter. Rates of lay from 3" to 50". Flyer speed 8 steps from 600 to 34 R.P.M. Handles large diameter wires on cradle reels.

An exceedingly efficient and versatile machine.

THE EDMANDS CO. 228 ABORN STREET PROVIDENCE 3, R. I.

DANFORTH

FIRST QUALITY—PROPERLY-GRADED

DIAMOND POWDERS

Will give you maximum • • •

Value • Service • Economy

For this you pay a little more in first cost, but you save in faster work, in superior die finish and in better wire drawn. DANFORTH POWDERS are uniform in purity, quality, grain shape and accuracy of grading.

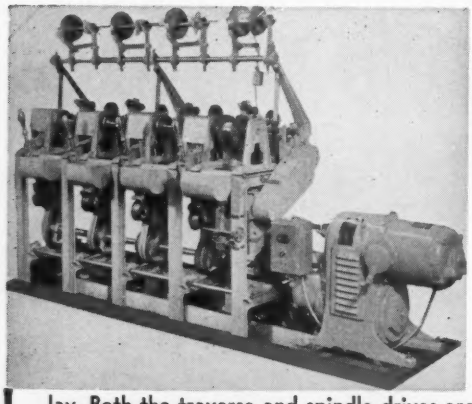
COMPLETE RECLAIMING SERVICE

The DANFORTH PROCESS of reclaiming produces powders that are *guaranteed* to be 99% or better pure.

Write today for information on diamond powders.

C. W. DANFORTH COMPANY

P. O. Box 448 Established in 1912 **Youngstown, Ohio**



1900-HV MULTIPLE SPINDLE SPOOLER

SPECIFICATIONS
Size Range: .010" to .080" or heavier if soft and many flat wire sizes.
Max. Spool Size: 16" flange diameter.
Capacity: usually 4 to 8 spindles.

The 1900-HV Spooler is a rigid, precision machine which will consistently produce a uniform, dense wire lay. Both the traverse and spindle drives are regulated through wide-range, stepless, variable speed units, eliminating change gears. The 1900-HV is completely adaptable to your particular constant or changing demands. All controls are positive. Adjustments are made accurately with the spooler in operation and without tools.

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not infrequently confronted with the problem of furnishing service to power stations. At these locations a high ground potential rise under fault conditions may occur. Polyethylene insulation with its high dielectric strength provides the necessary service reliability at a time when the power company can least afford a service interruption.

★ ★ ★

Currently the cost of PIC cable is somewhat higher than paper or pulp insulated conductors. We are, of course, looking to the day when this differential may be eliminated. There are a few problems which require further attention. Our experience to date, however, leads us to the firm conclusion that our present plant is better and cheaper and less costly to maintain because of the presence of plastic insulated conductors.

The Ichabod Washburn Story

(*Continued from page* 440)

drawing frame. It was of a pattern never before or since used for that purpose. It was planned to hold the "die" at one end and at the other end was a spindle upon which was wound a chain. This chain, with strong nippers at the end of it, was pulled out the length of the frame. The nippers firmly bit the end of the wire rod projecting from the die but, when the power was applied to the spindle, the whole contraption collapsed in a heap . . . without moving the wire rod through the die a particle.

★ ★ ★

Washburn, however, was not discouraged and kept experimenting until he came up with a machine which could draw about 15 feet in one pass. Not long after that he replaced this machine with a wire drawing block of the same basic principle as is found in use today.

★ ★ ★

Late in 1830 a Mr. Read came to Washburn and posed this problem: "Can you draw some rods, which I have, down to smaller sizes so that I can experiment in making wood screws?"

★ ★ ★

The answer was "yes" and Washburn immediately set about drawing wire for Read's wood screws. The volume of business increased and Washburn and Godard soon sold out their plant for making woolen machinery to Messrs. March, Goulding, Smith, and Hobart.

★ ★ ★

Their next step was to purchase a "water power" at Northville, just outside the thickly settled portion of Worcester, and put up the necessary factory for making wire for wood screws. This was in 1831 and was the real beginning of the wire industry in America.

★ ★ ★

In addition to making iron wire for wood screws they began making card wire for the woolen industry and within three years they had so far outgrown the limited water power that they were obliged to look elsewhere for a factory having greater capacity. Since none was available they engaged **Stephen Salisbury** to construct a dam and an 80-ft. by 40-ft. building at the place called Grove, on the Salisbury farm. This became the first building of the old North Works in Worcester. Although later sold by **American Steel & Wire Company**, many of the old North Works buildings are still being used today for light manufacturing by Worcester concerns.

★ ★ ★

In 1835, Washburn sold to Godard, for $2,000, his share in the Northville property owned by them in common. The partnership was amicably dissolved and Godard retained the factory at Northville for the manufacture of woolen machinery.

★ ★ ★

Ichabod Washburn took over the new Grove Mill under the firm name of Ichabod Washburn, Wire Manufacturer, and was well on his way toward developing the infant wire industry which he had started.

★ ★ ★

In 1850, Washburn took as his partner his son-in-law **Phillip Moen** under the firm name of **I. Washburn & Company, Wire Manufac-**

A Reading "Must" for Wire Men

"STEEL WIRE IN AMERICA"

by KENNETH B. LEWIS

This valuable book gives to men working in the wire industry a background of historical and technical information that provides a perspective on what is happening today.

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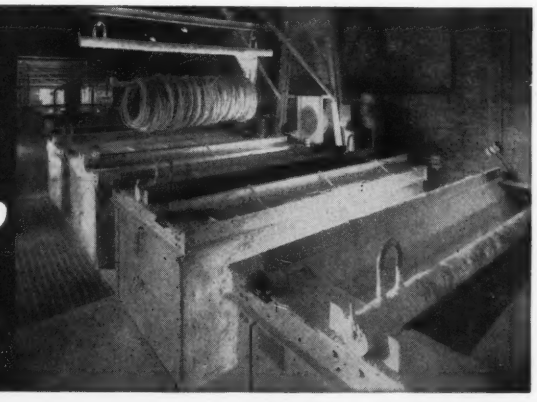

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turers—Ichabod Washburn and P. L. Moen, Proprietors. In the same year **Jonas Chickering,** a piano manufacturer in Boston, asked Washburn to try his hand at making steel wire for pianos. Until then it had been made exclusively by one English firm. Washburn developed the continuous process for tempering wire, which made it suitable for pianos, and for many years his company was the only manufacturer of piano wire in this country.

★ ★ ★

His experience in developing piano wire served Washburn well when the vogue of the hoop skirt came in around the late 1850's. Originally, whale bone was used to support the skirts, but it was very expensive. The process then used for making steel wire, of sufficient elasticity for the skirts, made steel wire also expensive.

★ ★ ★

By applying his continuous tempering method to a cheaper grade of cast steel, at very little extra cost, Washburn found it possible to make hoop skirt, or "crinoline" wire so cheaply that skirt manufacturers could put their goods on the market, furnished with steel wire hoops of great elasticity, at a price that was within the reach of even the poorest. For about 10 years, while the fashion lasted, Washburn and Moen supplied 60,000 pounds of hoop skirt wire a week, about one-half of all made in the United States.

★ ★ ★

From the days of his early experiments, up until the time of his death in 1868, **Ichabod Washburn** greatly improved wire making processes and brought them to a high level of craftsmanship. He has left us a legacy of ingenuity and enterprise that will indeed be difficult for us to match.

★ ★ ★

And so, **Ichabod Washburn,** pioneer of the wire industry, rightfully takes his place at the head of the parade of people from the pages of the past who have helped make American Steel & Wire the world's outstanding manufacturer of fine quality wire and wire products.

Modern Straightening and Cutting Equipment

(*Continued from page* 438)

ideas are being engineered constantly in an effort to meet this goal.

★ ★ ★

One of the first steps taken was the incorporation of variable speed drives in the machines. With this drive it is possible to change the rate of wire feed by just a slight turn of a handle. This allows the user to employ the machine for many different types of wires and get the highest possible speed for each.

★ ★ ★

On a number of models the cutting action can also be varied to give the user an excellent controlling feature when cutting short lengths of wire.

★ ★ ★

Within the past year the two major developments have been made on our machines. The first was a sliding action-positive-release target mechanism. This insures the wire dropping from the guide bar freely, eliminating the condition of wire getting caught in the guide bar. This target mechanism has allowed the speeding up of the rate of production.

★ ★ ★

Following close on the heels of this was the development of an electrically controlled roll type clutch. This has decreased the amount of friction to be overcome in tripping the wire cutting mechanism, allowing smaller diameter wire to be cut more accurately. This roll type mechanism affords a seemingly endless mechanical life to one of the most important parts of the machine.

★ ★ ★

Many additional developments are under continuous investigation to increase further the production rate and efficiency of present machines. Along with this many special types of wire straightening and cutting machines are also in the process of being designed in order to provide the wire industry with a machine able to meet any of its possible needs.

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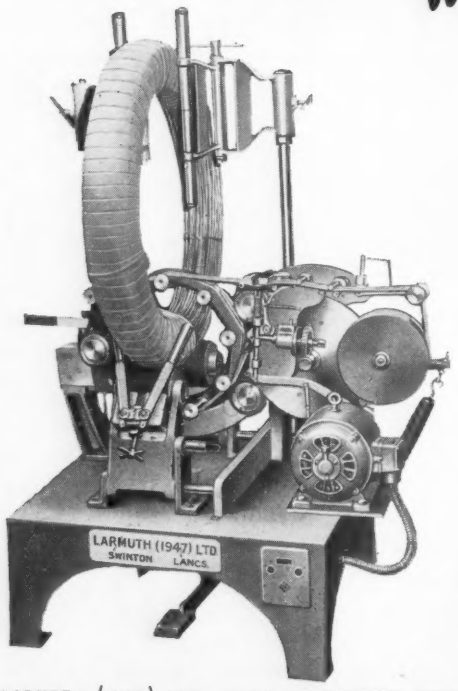

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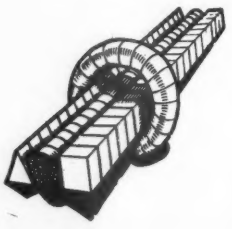

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The Wear of Diamond Dies

(*Continued from page* 419)

tions of a diamond face along which grinding is relatively more easily achieved. This is confirmed by diamond-working practice. The conclusion is reached that the least wear on a drawing die will occur if the hole is drilled perpendicular to an octahedral plane. This conclusion is checked against the etch patterns obtained by a special technique on the major faces of a diamond. Practical confirmation of these conclusions can only be obtained after a statistical examination of a great number of drawing dies.

General Properties of The New Super-Polyethylenes

(*Continued from page* 435)

The super-polyethylenes offer an unusual combination of properties: Improved heat resistance, greater rigidity, excellent low temperature impact strength, high tensile strength, and excellent appearance. It is this **combination** of properties which will fill a long-standing need and will complement other materials by broadening the entire spectrum of plastics applications.

Reports on Wire Doings in Foreign Fields

(Extracts from IRAHT-WELT, Dec. 20, 1955.)

Japanese Wire Exports To Increase

The Yawata Iron and Steel Co., Yawata, Japan, is expending some $16 Million to expand their Kyushi plant. This plant will then increase its yearly wire output to about 65,000 tons and become thus one of the most important wire exporters. Its wire nail and barbed wire production particularly are being expanded. Export shipments will commence early in 1957.

Red China Gets Wire from West Europe

From the Chinese National Import and Export Co. of Zurich,

with an East-Berlin Branch, comes the statement that for the year 1956 importation into China from West-Europe will include about 22,000 tons of wire. More of the shipments will be made through Shanghai, and no longer exclusively through Tientsin.

The Export Market Generally

Business in the export trade is uneven. Demands are generally weaker, as at the same time last year, especially for wire nails, loops and tacks. Business has, however, been rather steady during the whole year, with only small ups and downs due to seasonable causes, and it is to be hoped that this will not change much in the present year. In general a slight further decline in demand for wire nails is to be expected, while, on the other hand, requirements in all special products, among them wire rope, stranded wire, every kind of conductor wire, steel wire, spiral spring wire, can be termed good, with particularly higher turnovers in the coming months. The same is not to be expected in fence wire, but here the turnover may be termed satisfactory. Wire netting and mesh will remain in somewhat better demand.

Spanish Export to South America Increases

Spain is concerned to gain a stronger foothold for her wire exports to South America. Her export licenses for 1956 include: to Chili $51,000; to Argentina $73,000; to Uraguay $4,000; to Paraguay $27,000; to Venezuela $39,000; to Colombia $44,000; etc. But a beginning is being made, and for 1957 it is expected that these figures will be doubled or trebled. Cable and conductor wire are the most important items. Spain is further concerned to export spoke wire for bicycles and motor-bikes.

Czech Engineers Building New Plants

Among these eleven are reported which will manufacture wire products. In Argentina the wire rod capacity is being expanded and a plant for wire netting is being built; in Egypt a plant for wire

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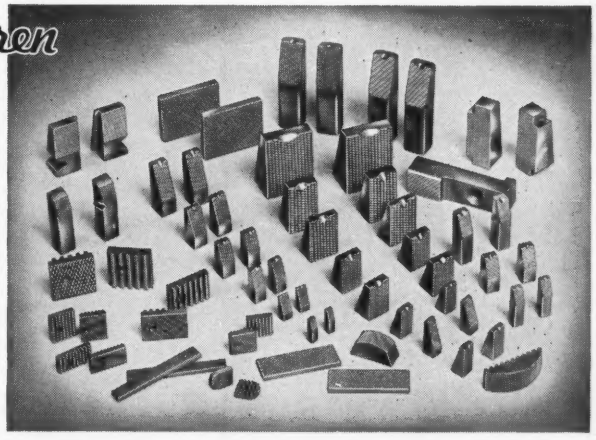

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mesh; in Siam a wire-nail plant; in Indonesia one for wire nails, loops and barbed wire; in Bolivia for barbed wire and other wire material; in India wire nails, loops, fence wire, etc. All of these plants are to be delivered by Czecho-Slovakian firms.

West German Wire Exports Decline

The West-German wire industry is reportedly worried about the drop in its export business from about 160,000 metric tons (or about 19% of total production) in 1954 to only a little over 115,000 tons (which is some 14% of production) in 1955.

★ ★ ★

The industry, which feels it cannot lower its export prices further without endangering remunerativeness, blames British and Netherlands competition—particularly in the field of special wire products—for this situation.

"Fun With Wire"

An interesting new book "Fun With Wire" has just been published by **J. B. Lippincott Co.**, East Washington Square, Philadelphia, Pa., illustrating and describing many items that can be made of wire as a hobby. The book sells for $3.00.

★ ★ ★

A great variety of objects, from flowerpots to jewelry, can be made with wire. The text describes the kinds of wire suited to different items and shows clearly the methods that may be used in their forming. Instructions are detailed and easy to follow.

★ ★ ★

The author is Joseph Leeming, who previously wrote "Fun With Pencil and Paper" and "Fun With Beads".

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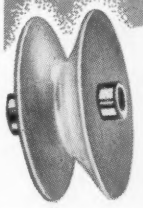

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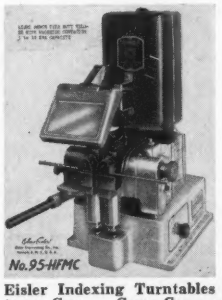

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Current C F & I Expansion Nearing Completion

The Colorado Fuel and Iron Corporation will have spent some $23 million in the fiscal year ending June 30, 1956 on its program of plant modernization and development, according to **A. F. Franz,** president. Expenditures cover improvement of properties in both its Western and Eastern divisions.

★ ★ ★

At Buffalo, ingot capacity of the open hearth furnaces will be increased by about 120,000 tons per year. This parallels an anticipated increase of 200,000 tons per year in the ingot capacity of the Pueblo mill. The Buffalo rod mill has been completely modernized and production of rods is expected to be doubled.

★ ★ ★

New wire drawing and finishing equipment is now being installed at Buffalo to consume this increased steel production. The benefits gained from the modernization of the Buffalo plant will be reflected in other fabrication plants in the Wickwire Spencer Division, since Buffalo supplies rods and wire to these plants.

★ ★ ★

At the Palmer, Mass. plant, which produces wire and wire rope, a large new building is under construction.

★ ★ ★

An old plant at Worcester, Mass., whose buildings did not warrant rehabilitation or expansion will be

closed, and its equipment transferred to Palmer. This equipment will be augmented by new modern machinery.

★ ★ ★

Improvements are also in progress at the Clinton, Mass., plant where industrial screens, conveyor belts, and other wire products are manufactured.

★ ★ ★

At Roebling, in keeping with CF&I's policy of expansion and modernization, numerous projects have been completed and others are now in progress. They include new power facilities, new equipment for the electrical wire and cable department, new wire drawing machines, and other related finishing facilities.

Bethlehem Pacific Increases Capacity

Increased production potential of automatic hay bailing wire was seen recently in the announcement by **Bethlehem Pacific Coast Steel Corporation** of an increase in the rated ingot capacity at the company's Los Angeles Plant. The increase is from 402,000 ingot tons annually in 1955 to 450,000 ingot tons per year for 1956.

★ ★ ★

The company's wire mill in Los Angeles, the largest on the west coast, is a completely integrated operation, from billet to finished wire. Last year, a completely new wire galvanizing line was added to the mill to round out its drawing and finishing facilities.

★ ★ ★

Company spokesmen pointed out that present drawing schedules of automatic hay baling wire accommodate all makes of bailing equipment. This includes the 14½ gauge for the Interim 6500 and 3150 coil sizes as well as the 8200 foot, 15½ gauge wire for spindle needle (Case) balers.

★ ★ ★

Production of these wires is kept in close coordination with the steel mill's quality control laboratory to assure a high quality of baling wire.

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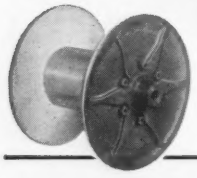

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External Loads Don't Always Add to Bolt Stresses

Stress conditions vary for different types of joints, say **Russell, Burdsall & Ward,** fastener experts, yet many engineers operate under the fallacy that external loads always add to the stress in the bolt.

★ ★ ★

In a rigid joint, one where two hard surfaces are bolted together and may be considered a solid unit, external loading does not increase stress in the bolt unless the external load is greater than the residual tension in the bolt.

★ ★ ★

In a flexible joint, external loading adds to the tightening stress. Bolt stress is thus the sum of residual tension plus external load. A flexible joint is one in which 1) two soft surfaces are bolted together, 2) one hard and one soft surface are bolted together, or 3) two surfaces, separated by a gasket to prevent leakage, are bolted together.

★ ★ ★

In a rigid joint, the bolt should be torqued as near as possible to its yield strength so that it will resist a maximum amount of external load without loosening. In a flexible joint, the bolt should be torqued just enough to prevent leakage, leaving the balance of its strength to take care of external loading.

Alloy Metal Wire Producing New Nickel Alloy Wire

Now being fabricated into wire at **Alloy Metal Wire Division** is the new **International Nickel Company** alloy, Nionel. The new alloy contains a mixture of nickel and chromium plus additions of molybdenum and copper. It is able to withstand severe corrosive conditions. Nionel is especially resistant to certain hot acids, including sulfuric, sulfurous, nitric and phosphoric. It also resists oxidizing chemicals like nitrates and many salts of copper, iron and mercury. It is highly resistant to most organic acids as well as to general corrosion pitting and stress corrosion cracking by sea water and

other chloride containing waters.

★ ★ ★

Nionel is an exceptional alloy for use in the chemical industry, in petroleum refineries, detergent plants, synthetic fabric production and pulp plants.

★ ★ ★

The wire can be supplied in sizes .002″ to 3/16″. Flat wire also available.

★ ★ ★

For additional information write to Alloy Metal Wire Division, H. K. Porter Company, Inc., Prospect Park, Pa.

Folder on Single Stack Annealing Furnaces

The Lee Wilson Engineering Co., 20005 West Lake Road, Cleveland 16, Ohio, has issued a new bulletin comparing the efficiency of single stack and multiple stack annealing furnaces.

★ ★ ★

In it the company states that the central control system of the single stack operation eliminates guesswork, improves working conditions and increases output per man-hour.

★ ★ ★

For copies of this folder, write to the company.

Titan to Erect Plant Near San Francisco

The Titan Manufacturing Company, Bellefonte, Pa., has announced plans for a new brass mill to be constructed in the San Francisco Bay area. Cost of this new plant is expected to be in excess of $1,000,000.

★ ★ ★

President W. W. Sieg said Titan Metal Manufacturing has taken possession from the Southern Pacific Company of a forty acre site at Newark, in Southern Alameda County.

★ ★ ★

Plans call for construction to start this year on a rod mill designed to produce standard and specialty copper base alloys. Nickel, chromium, zirconium, beryllium, silicon, manganese, aluminum, and titanium will be used as alloying elements in the production of specialty copper base alloys.

★ ★ ★

Proposed facilities will enable Titan to fabricate engineering and specialty alloys covering a wider range in the copper base alloy field. The company's products are extruded brass rod, bar and shapes; brass wire, brass die castings; brass and aluminum forgings; bronze welding wire, and boat shafting.

Open Pit Operations Begin at Boron Mine

Start of open pit mining, major step in the $18,000,000 development of the world's only known sodium borate deposit, went into effect in January.

★ ★ ★

Inaugurating the conversion from 30 years of shaft-tunnel operations, **J. M. Gerstley,** president of the **Pacific Coast Borax Co.,** a division of **Borax Consolidated, Limited,** said the project, including construction of new refining and concentrating plants, is expected to be completed next year.

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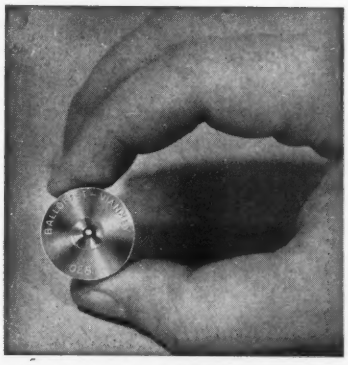

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ABSTRACTS

MATERIALS: SINTERED CARBIDE DOUBLES NOZZLE LIFE

Merco Centrifugal Co, San Francisco, Calif. Iron Age 1955 Vol 176 (18) pp 125-126 (Nov 3)

Centrifuges use tiny nozzles, inner dia 0.035 to 0.156 in., outer dia ⅛ to ¾ in., for handling liquids and particles at separating forces 9,000 × that of gravity. Frequent replacement required owing to abrasive action of materials. Attempt at rubber lining failed. With adoption of carboloy grade 999 tungsten carbide, nozzles achieved 8 to 12 mth service life. 1 illustr.

APPARATUS FOR ACCURATE MEASUREMENT OF THE DIAMETER OF FINE WIRE

I. G. Morgan (NPL). Machinery (London) 1955 Vol 87 (2242) pp 1097-1099 (Nov 4)

Determination of absolute wire dia and variation along length to ±0.00001 in. accuracy up to about 0.01 in. dia. Wire lies between fixed anvil attached to base plate and movable anvil attached to balanced beam. Tilt of beam and mirror fastened to it varies with wire dia between anvils. Variations measured by autocollimator. Very light contact load about (g) at measuring anvils. Parallel faced lap located off base plate used for lapping contact face of anvil during operation. Instrument suitable for measurement of small precision balls. 3 illustr.

PROBLEMS OF FINE WIRE TECHNOLOGY

A. Forstmeyer. Feingeraetetechnik 1954 Vol 3 pp 473-476; Wire Prodn 1955 Vol 4 (12) pp 15, 17-18 (Nov) (Original in German)

See Bibl Ind Diamond Appl 1955 Vol 12 p B12 (Jan).

STUDIES ON WIRE DRAWING WITH BACK TENSION [BACK-PULL]. V. ON PHOSPHOR-BRONZE WIRE

I. Gokyu, H. Takahashi, M. Kobayashi. Nippon Kinzoku Gakkai-Si 1953 Vol 17 (2) pp 96-100; Inst Met Journ: Metall Abstr 1955 Vol 23 (4) col 367-368 (Dec) (Original in Japanese)

THE REDUCTION OF TUNGSTIC OXIDE: ELECTRON MICROSCOPE STUDY OF THE REDUCTION PROCESS

O. Herrmann. Metall 1954 Vol 8 (19/20) pp 759-764; Inst Met Journ: Metall Abstr 1955 Vol 23 (2) col 118 (Oct) (Original in German)

Conclusion reached that according to type of addition made to WO_3 powder, grain-growth of W particles formed during reduction can be promoted or suppressed influencing recrystallization characteristics of W in all subsequent processing into lamp filaments.

TWO DIMENSIONAL PROFILE OF DRAWING DIE AND EXTRUDING NOZZLE BY PLASTICITY THEORY

M. Kakuzen. 1st Jap Nat Congr Appl Mech 1951 Proc 1952 pp 241-244; Appl Mech Rev 1955 Vol 8 p 25; Inst Met Journ: Metall Abstr 1955 Vol 23 (4) col 370 (Dec)

Various assumptions made on stresses in drawing with rough dies; shown that if friction coeff is constant, die geometry

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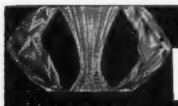

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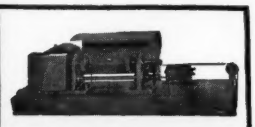

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determined. Concluded that this design corresponds to 'uniform flow' conditions.

EFFECT OF STEEL WORK PROCESS UPON DRAWING ABILITY AND MECHANICAL PROPERTIES OF SOFT STEEL WIRES

O. Modracek. Hutnické Listy 1955 Vol 10 (12) pp 715-720 (Dec) (In Czech; summary in Russian, German, French and English)

6 illustr, 2 ref, 2 tables.

WIRE-DRAWING MACHINES FOR STEEL WIRE

H. Richards. Iron & Steel Inst Journ 1955 Vol 181 (4) pp 349-351 (Dec)

Discussion on paper; see Bibl Ind Diamond Appl 1955 Vol 12 p B187 (July).

2 illustr.

ON THE APPLICATION OF THE THEORY OF PLASTICITY TO HARDNESS TESTING AND WIRE DRAWING

Y. Yamada. 1st Jap Nat Congr Appl Mech 1951 Proc 1952 pp 231-236; Appl Mech Rev 1955 Vol 8 p 25; Inst Met Journ: Metall Abstr 1955 Vol 23 (4) col 274 (Dec)

Considers slip-line fields for plain-strain indentation by a cylinder and plain-strain drawing though die with circular entry for range of reductions where slip-line field intersects axis of symmetry in single point. No velocity boundary conditions considered.

Wire and Cable Company Moves Office

Ampere Wire and Cable Corp. has announced the removal of its New York City offices and warehouse to 732 Eleventh Ave., New York 19, N. Y. (near 51st St.). The plant remains as before at 4 Bashford St., Yonkers, N. Y.

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Dravo Lube System Used on Rod Mill

Complete lubrication systems for the new merchant bar and rod mill at **Atlantic Steel Co.**, Atlanta, Ga., will be supplied by the **Dravo Corporation,** Pittsburgh.

★ ★ ★

The new mill, which is being constructed as a part of Atlantic's recently announced ten-million-dollar expansion program, will have a rod and bar capacity of 1,000 tons daily.

★ ★ ★

For lubricating this new mill, Atlantic will utilize three specially engineered Dravo-DeLaval lubrication systems that will provide full flow continuous filtration with automatic temperature and pressure control. The systems will provide 472 gallons of lubrication per minute for the new mill, which was designed by **Morgan Construction Company,** Worcester, Mass.

★ ★ ★

Atlantic Steel, Georgia's only steel mill, manufactures bars, rods, small shapes, wire and wire products, marketed under the trade name "Dixisteel."

Fastener Firm Makes Executive Shifts

Howard R. Swartz and **Frank L. Sonneman** have been made assistants to the president of **Pittsburgh Screw & Bolt Corp.,** Pittsburgh. Mr. Swartz had been general sales manager of **Cleveland Cap Screw Co.** and Mr. Sonneman, who had been general manager, bolt and nut division, Murray Corp., is now in charge of manufacturing at Pittsburgh Screw & Bolt.

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Index to Advertisers

A

Acrometal Products, Inc. 420
Ajax Electric Company, The 378
Ajax Industrial Supplies, Inc. 484
Ajax Manufacturing Company, The 411
Allis Company, Louis, The 374
Alloy Metal Wire Div., H. K. Porter Co., Inc. 445
American Insulating Machinery Company 459
American Lanolin Corp. 481
American Woodworking Co. 485
Angier Corporation 458
Apco Mossberg Co. 444
Apex Alkali Products Co. 485
Arkell Safety Bag Company 399
Arms, Clarence S. 486

B

Balloffet-Vianney Wire Die Co., Inc. 483
Bethlehem Steel Company 366
Bick, Hans C., Inc. 468
Boulin, Victor J., Inc. 484
Boyd & Sons Mfg. Corp. 470
Brenon, Inc. 484
Bridge Mfg. Co. 375

C

Camden Wire Co., Inc. 462
Carboloy Dept. of General Electric Co. 370
Carl Mayer Corp., The 473
Carpenter Steel Company-Webb Wire Division ..... 470 and 485
Cedar West Tool Co., Inc. 383
Chase Brass & Copper Co. 371
Chemsteel Construction Co., Inc. 485
Cleveland Tramrail Division of The Cleveland Crane & Engineering Co. 372
Cochaud Wire Die Inc. 484
Colorado Fuel & Iron Corporation ..... 380 and 381
Continental Can Company 426
Continental Steel Corporation 446
Cook Mfg. Co. 467
Coulter & McKenzie Machine Co., Inc., The 432
Crafts, Arthur A., Co., Inc. 471
Crucible Steel Company of America 387

D

Danforth Co., C. W., The 472
Davis-Standard Sales Corp. 396-B
Drever Company 385
Durant Mfg. Co. 468
Durkee Mfg. Co., Inc. 481
Dykrex Corporation of America—Roos Tool & Mfg. Div. 469

E

Eastern Carbide Corp. 482
Edmands Company, The 471
Eisler Engineering Co., Inc. 479
Electric Furnace Company, The ..... Back Cover
Electronic Rubber Co. 474
Elgin National Watch Co., Abrasives Div. 436
Emory, Robert J., Company 472
Engis Equipment Co., Hyprez Div. 388
Entwistle Mfg. Corp. 390
EVG, Maschinen & Stahl 396

F

Fenn Manufacturing Co., The 447
Firth Sterling, Inc. 394
Fisher Associates 486
Fort Wayne Diamond Products, Inc. 484
Fort Wayne Wire Die, Inc. 484

G

Glader, Wm., Machine Works 449

H

Haskell-Dawes Machine Co. 474
Heany Industrial Ceramics Corp. 479
Herborn Maschinenfabrik 408
Hubbard Spool Company 401

I

Indiana Wire Die Company 484
Industrial Gauges Corporation 376
Industrial Ovens, Inc. 439
Interlocking Fence Co. 464
International Wire Products Corp., Woodside Machinery Div. 409

J

Johnson Steel & Wire Company, Inc. ..... 404 and 405
Jury's Wire Products Inc. 485

K

Kaiser Aluminum & Chemical Sales, Inc. 384
Kellogg Company, M. W., Chemical Mfg. Div. 377
Kelly Wire Die Corp. 484
Kennametal, Inc. 392
Keystone Steel & Wire Co. 443

L

Lancaster, Allwine & Rommel 486
Larmuth (1947), Ltd. 476
Litzler Co., Inc., C. A. 448

M

Magnuson Products Corporation 475
Malm & Company, The 481
Maschinen & Stahl, A.G.—EVG 396
Mason Can Company 451
Metal Carbides Corporation 410
Mettler Machine Tool, Inc. 407
Micro Products Company 442
Miller, R. H. Co., Inc. 414
Milton Machine Works, Inc. 482
Molina-Straus Diamond Products Co. 484
Monsanto Chemical Co., Plastics Division 386
Montgomery Co., The 480
Morgan Construction Company 368
Morgardshammars Mek. Verkstads A. B. 373
Mossberg Pressed Steel Corp. 458
Muncy Valley Industries, Inc. 479

N

National Machinery Exchange 485
National Lock Washer Company 367
National Research Co. 478
National Standard Co. 393
National Waterproof Papers, Inc. 485
National Wire Die Company 484
Nelson Co., The 485
New England Butt Co. 480
New England Wire Die Co. 484
Nilson Machine Co., A. H., The 454
North Anson Reel Co. 398
Norton Company 461

O

Orchard Paper Company 475

P

Pacific Coast Borax Company 469
Parkin Chemical Co., The 476
Pennsylvania Salt Mfg. Company 406
Peschel Electronics, Inc. 478
Pittsburgh Carbide Die Co. 484
Pittsburgh Plate Glass Co. 400
Pittsburgh Steel Company ..... 404 and 405
Platt Brothers & Co., The 485
Plymouth Cordage Company 455
Porter, H. K., Inc. 478
Pourtier, Pere et Fils 465

R

Republic Steel Corp., Pressed Steel Div. 369
Robinson, M. W., Co., Inc. 478
Rockwell Company, W S. 453
Roebling's, John A. Sons, Corp. 396-A
Rome Soap Mfg. Co. 485
Royle, John & Sons 450
Rusch Wire Die Corporation 484

S

Scott Testers, Inc. 485
Scovill Mfg. Company 389
Scudder, E. J., Foundry and Machine Co. 485
Seybold Transworld Exporters 480
Sheffield Steel Division, Armco Steel Corporation 452
Sjogren Tool and Machine Co., Inc. 477
Sleeper & Hartley, Inc. 485
Standard Industrial Compounds Co., Inc. 365
Standard Mill Supply Co. 456
Strand-Buffalo Corp. 485
Syncro Machine Co. 379

T

Terkelsen Machine Company 485
Torrington Mfg. Co., The 395

U

Union Wire Die Corp. 477
U. S. Industrial Chemicals Co., Division of the National Distillers Products Corporation 403
U. S. Industrial Diamond Products 457
Universal Industrial Equipment Corp. 463
Universal Wire Die Co. 484

V

Vascoloy-Ramet Corp. 412
Vaughn Machinery Co., The ..... Front Cover

W

Wafios Maschinenfabrik 462
Warner Company 483
Waterbury Farrel Foundry & Machine Co. 485
Watson Machine Co., The ..... Inside Back Cover
Wayne Wire Die Co. 482
Wells, Frank L., Co. 466
Wickwire Brothers, Inc. 482
Wilson, Lee, Engineering Co., Inc. ..... Inside Front Cover
Wire Equipment Mfg. Co., Inc. 483
Wire Insulating Machinery Inc. 460
Wire & Textile Machinery, Inc. 481
Wire Tool Div., Bridgeport Jig Boring Co. 480

Y

Youngstown Sheet & Tube Co., The 391
Youngstown Welding & Engineering, The 402

WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.
Only advertisers who have contracted for six or more insertions are listed in this section.

ABRASIVES—
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Norton Co., Worcester, Mass.
United States Industrial Diamond Corp., New York, N. Y.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ACID-PROOF CONSTRUCTION—
Chemsteel Construction Co., Inc., Pittsburgh, Pa.

ADJUSTABLE SPEED DRIVES
The Louis Allis Company, Milwaukee, Wisc.

ANNEALING MACHINES — Electric Resistance
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

BAKERS—
(See OVENS—Rod Bakers)

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc (used) Pawtucket, R. I.

BORAX—Wire Drawing
Pacific Coast Borax Co., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

CABLE FILLERS—Paper
Plymouth Cordage Company, Plymouth, Mass.

CAPSTANS—for Wire
Litzler, C.A., Co., Inc., Cleveland, Ohio.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Rome Soap Manufacturing Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

CLEANING & PICKLING EQUIP.—
Chemsteel Construction Co., Inc., Pittsburgh, Pa.
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee Engr. Co., Cleveland, Ohio
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

CLOTH—WIRE, All Metals
Baker, James S., (Imports) Co., 311 California St., San Francisco, Calif.
Chase Brass & Copper Co., Waterbury, Conn.
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Pennsylvania Salt Mfg. Company, Philadelphia, Pa.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago.
Rusch Wire Die Corporation, Croton-on-Hudson, N. Y.
Union Wire Die Corporation, New York, N. Y.

COMPOUNDS—Extrusion, for Wire
Electronic Rubber Co., Stamford, Conn.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.

COMPOUNDS—For Improving Drawing and Extrusion
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Phosphate Coating
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corporation, Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Rome Soap Manufacturing Co., Rome, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS, Vinyl
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Ironsides Co., The, Columbus, Ohio.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H. Co., Inc., Homer, N. Y.
Pacific Coast Borax Co., New York, N. Y.
Pennsylvania Salt Mfg. Company, Philadelphia, Pa.
Rome Soap Manufacturing Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
Swift & Company, Chicago, Ill.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.
Willey's Carbide Tool Co., Detroit, Michigan.

CUTTING TOOLS—Wire
Porter, H. K. Inc., Somerville, Mass.
Robinson, M. W. Co., Rockfall, Conn.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Molina-Straus Diamond Products Co., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
United States Industrial Diamond Corp., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Industrial Diamond Powders, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Molina-Straus Diamond Products Co., New York, N. Y.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Union Wire Die Corporation, New York, N. Y.
United States Industrial Diamond Corp., New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Danforth, The C. W. Co., Youngstown, Ohio
Industrial Diamond Powders, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
National Research Co., St. Clair Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Union Wire Die Corporation, New York, N. Y.

DIAMOND TOOLS—
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Molina-Straus Diamond Products Co., New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Michigan.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Michigan.

DIES—Cold Heading
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Union Wire Die Corporation, New York, N. Y.
Vascoloy-Ramet Corp., Waukegan, Ill.
Willey's Carbide Tool Co., Detroit, Michigan.

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., New Brunswick, N. J.
Cochaud Wire Die Inc., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N.Y.
Union Wire Die Corporation, New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES DIAMOND—Reversible
National Wire Die Co., New York, N. Y.

DIES—Extrusion
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Michigan.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc, New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Cochaud Wire Die Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die., Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
National Wire Die Co., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Union Wire Die Corporation, New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., Waukegan, Ill.
Willey's Carbide Tool Co., Detroit, Michigan.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Electric, Adjustable Speed
The Louis Allis Company, Milwaukee, Wisc.

DRUMS—Wire Packaging
Continental Can Company, Van Wert, Ohio

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Co., Garrett, Ind.
New York Engineering Co., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

DRYING EQUIPMENT
Carl Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

ENGINEERS—Consulting
Lubricants—Hans C. Bick, Inc., Reading, Pa.
Wire Mill—Clarence S. Arms, Worcester, Mass.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FREQUENCY CHANGERS
The Louis Allis Company, Milwaukee, Wisc.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Co., Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Drever Company, Bethayres, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., Fairfield, Conn.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

FURNACES—Resistance Heating, Strand
(See Annealing Machines)

FURNACES—Salt Bath
Ajax Electric Co., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

FURNACES—Strand Annealing
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.

GAUGES—Wire Diameter, Continuous
Industrial Gauges Corporation, West Englewood, N. J.

GALVANIZING EQUIPMENT — (See MACHINERY—Galvanizing Wire)

GEARMOTORS
The Louis Allis Company, Milwaukee, Wisc.

GRINDERS—Roll
Norton Co., The, Worchester, Mass.

GUIDES—For Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HARDSURFACING ALLOYS—
(See Alloys—Hardsurfacing)

HOOKS—Pickling & Liming
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Kellogg Company, M. W., Chemical Manufacturing Division, Jersey City, N. J.

INSULATING MATERIALS—
Celanese Corporation of America, New York, N. Y.
Chemical Products Co., E. Providence, R. I.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Electronic Rubber Co., Stamford, Conn.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Pittsburgh Plate Glass Company, Pittsburgh, Pa.
Plymouth Cordage Company, Plymouth, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.

INSULATING MATERIALS—Paper (For Electric Wire Cable)
Plymouth Cordage Company, Plymouth, Mass.

LACQUERING SYSTEMS — See MACH.—Lacquering Electric Wire

LACQUERS—For Electric Wire
Chemical Products Co., E. Providence, R. I.

LAGGING—Reel
North Anson Reel Co., No. Anson, Me.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The, Philadelphia and Bellefonte, Pa.

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Rome Soap Mfg. Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.
Ironsides Co., The, Columbus, Ohio

LUBRICANTS—for Metal Cutting, etc.
Ironsides Co., The, Columbus, Ohio

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Bending Wire
Eisler Engineering Co., Newark, N. J.

MACHINERY—Bobbin Winders
Cedar West Tool Inc., New York, N. Y.
Mummert-Dixon Company, Hanover, Pa.
Wire Equipment Mfg. Co., Trenton, N. J.

MACHINERY—Braiding
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Providence, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Haskell-Dawes Machine Co. Philadelphia, Pa.
New England Butt Co., Providence, R. I.
New York Engineering Co., Yonkers, N. Y.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding
Schumag Schumacher Metallwerke, Aachen Germany.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Closing Rope
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Coil Wrapping (Paper)
Angier Corporation, Framingham, Mass.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
National Mach'y Exch. (Used), New York.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Wells, Frank L., Co., Kenosha, Wis.

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Herborn, Germany.

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. General Electric Co., Detroit, Mich.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Union Wire Die Corporation, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Rockwell Co., W. S., Fairfield, Conn.

MACHINERY—Extruding
Davis-Standard Sales Corp., Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.

MACHINERY—Flat Wire
Fenn Manufacturing Co., Newington, Conn.
Mettler Machine Tool, Inc., New Haven, Conn.
Rockwell, W. S., Company, Fairfield, Conn.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming Wire
Baird Machine Co., Stratford, Conn.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Sales Corp., Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia.
Cook Mfg. Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, O.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Cedar West Tool Inc., New York, N. Y.
Mummert-Dixon Co., Hanover, Pa.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee. Wis.
Entwistle Manufacturing Corporation, Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Baird Machine Co., The Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.
Seybold Transworld Exporters, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.

MACHINERY—Pickling
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.

MACHINERY—Plating
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury Conn.

MACHINERY—Pumps for Molten Metal
Wire Equipment Mfg. Co., Trenton, N. J.

MACHINERY—Re-Spooling
Boyd & Sons Manufacturing Corporation, Philadelphia, Pa.
Emory, Robert J., Co., Newark, N. J.
International Wire Products Corp., Woodside Machinery Division, Midland Park, N. J.
Mummert-Dixon Co., Hanover, Pa.
National Mach'y Exch. (Used), New York.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.
Wire Insulating Machinery Inc., Northboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Rod Mill
Fenn Manufacturing Co., Newington, Conn.
Morgan Construction Co., Worcester, Mass.
Schumag Schumacher Metallwerke, Aachen, Germany

MACHINERY—Rolling Mill
Fenn Manufacturing Co., Newington, Conn.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Sales Corp., Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Spark Testing
Entwistle Manufacturing Corporation, Providence, R. I.
Peschel Electronics, Inc., New Rochelle, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Staple
Nilson, A. H. Machine Co., Bridgeport, Conn.
Seybold Transworld Exporters, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Straightening & Cutting
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Stranding
Haskell-Dawes Machine Co., Philadelphia, Pa.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Fenn Manufacturing Co., Newington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Sales Corp., Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Fenn Manufacturing Co., Newington, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
New York Engineering Co., Yonkers, N. Y.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Peschel Electronics, Inc., New Rochelle, N. Y.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Turks Head
Fenn Manufacturing Co., Newington, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Providence, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Emory, Robert J., Newark, N. J.
Fenn Manufacturing Co., Newington, Conn.
Mummert-Dixon Co., Hanover, Pa.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.
Wire Insulating Machinery Inc., Northboro, Mass.

MACHINERY—Wire Drawing
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fenn Manufacturing Co., Newington, Conn.
Herborn, Herborn, Germany
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Morgan Construction Co., Worcester, Mass.
Morgardshammers Mek Verstads AB, Morgardshammer, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Schumag Schumacher Metallwerke, Aachen, Germany
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

MACHINERY—Wire Forming
Baird Machine Co., The, Stratford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MOTORS—Electric, A. C. & D. C.
The Louis Allis Company, Milwaukee, Wisc.

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Rockwell Co., W. S., Fairfield, Conn.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAPER—Creped Wrapping
Angier Corporation, Framingham, Mass.
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corporation, Framingham, Mass.
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—Insulating
Plymouth Cordage Company, Plymouth, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PICKLING—Hooks, etc. Acid Resisting
Youngstown Welding & Eng'g Co., Youngstown, Ohio

PICKLING TANK LININGS—
Chemsteel Construction Co., Inc., Pittsburgh, Pa.

PLASTICIZERS—
Celanese Corporation of America, New York, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

PLASTICS—for Wire Insulation
Celanese Corporation of America, New York, N. Y.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Electronic Rubber Co., Stamford, Conn.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio

PUMPS—Molten Metal
Fisher Associates, New York, N. Y.

REEL AND TENSION STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.
New York Engineering Co., Yonkers, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Garrett, Ind.
Milton Machine Works, Inc., Milton, Pa.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Garrett, Ind.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

REELS—Metal Bound
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
North Anson Reel Co., No. Anson, Me.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Co., Garrett, Ind.
Nelson Company, The, Baltimore, Md.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L. Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Garrett, Ind.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New York Engineering Co., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
Mason Can Company, East Providence, R. I.
Mettler Machine Tool, Inc., New Haven, Conn.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New York Engineering Co., Yonkers, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
North Anson Reel Co., No. Anson, Me.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Nelson Company, The, Baltimore, Md.
North Anson Reel Co., No. Anson, Me.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Crucible Steel Co. of America, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Chase Brass & Copper Co., Waterbury, Conn.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Titan Metal Manufacturing Co., Bellefonte, Pa.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Sheffield Steel Corp., Kansas City, Mo.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—Rust Preventing)

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio
New York Engineering Co., Yonkers, N. Y.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—(See Reels & Spools)

SPOOLS—Stamped Metal for Retail Wire Sales
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TANKS—Compound
New York Engineering Co., Yonkers, N. Y.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling and Plating
Chemsteel Construction Co., Inc., Pittsburgh, Pa.

TESTERS — INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper, Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.
Wire Equipment Mfg. Co., Trenton, N. J.

TOOLS—Wire Cutting
Porter, H. K. Inc., Somerville, Mass.

TOOLS—Spring Forming, Carbide
Crafts, Arthur A., Company, Inc., Boston, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
Chemical Products Co., E. Providence, R. I.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire Insulating Machinery Inc., Northboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Entwicklungs Verwertungs Gesellschaft Graz, Austria
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIRE—Aluminum
Alabama Wire Company, Florence, Ala.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Chase Brass & Copper Co., Waterbury, Conn.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Jury's Wire Products, Inc., Bloomfield, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Bunched & Stranded, Copper
Camden Wire Co., Camden, N. Y.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Camden Wire Co., Camden, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind
Crucible Steel Co. of America, Pittsburgh, Pa.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Steel Corp., Kansas City, Mo.
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Camden Wire Co., Inc., Camden, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Jury's Wire Products, Inc., Bloomfield, N. J.
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
Camden Wire Co., Camden, N. Y.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat, Fine
Montgomery Co., The, Windsor Locks, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Manufacturers
Alabama Wire Company, Florence, Ala.
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Steel Corp., Kansas City, Mo.
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio

WIRE—Needle
Carpenter Steel Company, Webb Wire Division, New Brunswick, N. J.

WIRE—Nickel Alloy
Carpenter Steel Company, Webb Wire Division, New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Malin & Co., The, Cleveland, Ohio
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Crucible Steel Co. of America, Pittsburgh, Pa.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.

WIRE—Silver Plated Copper
Camden Wire Co., Camden, N. Y.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.

WIRE—Special Shapes
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Spring
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Carpenter Steel Company, Webb Wire Division, New Brunswick, N. J.
Crucible Steel Co. of America, Pittsburgh, Pa.
Firth Sterling, Inc., Pittsburgh, Pa.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
National Lock Washer Company, The, Newark, N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Steel—Also Coppered and Galvanized Steel
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jury's Wire Products, Inc., Bloomfield, N. J.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Tinned Copper
Camden Wire Co., Camden, N. Y.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Jury's Wire Products, Inc., Bloomfield, N. J.

WIRE—Weaving
Alabama Wire Company, Florence, Ala.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARNS & TAPES—Insulating
Celanese Corporation of America, New York, N. Y.
Pittsburgh Plate Glass Company, Pittsburgh, Pa.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE AND MASTICATING MACHINERY MANUFACTURERS

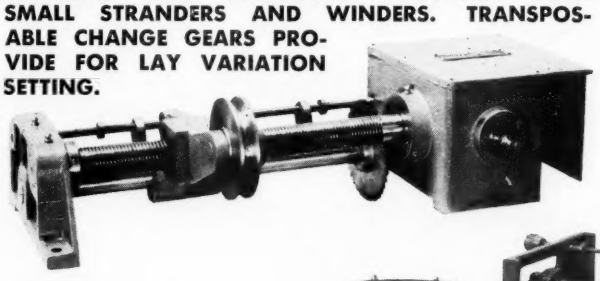
WATSON

AUTOMATIC TRAVERSES

STANDARD STOCK MODELS SHOWN. SUITABLE AS REPLACEMENTS OF INADEQUATE MECHANISMS. ADAPTABLE TO APPLICATIONS WHERE A POWERFUL RECIPROCATING MOTION IS REQUIRED.

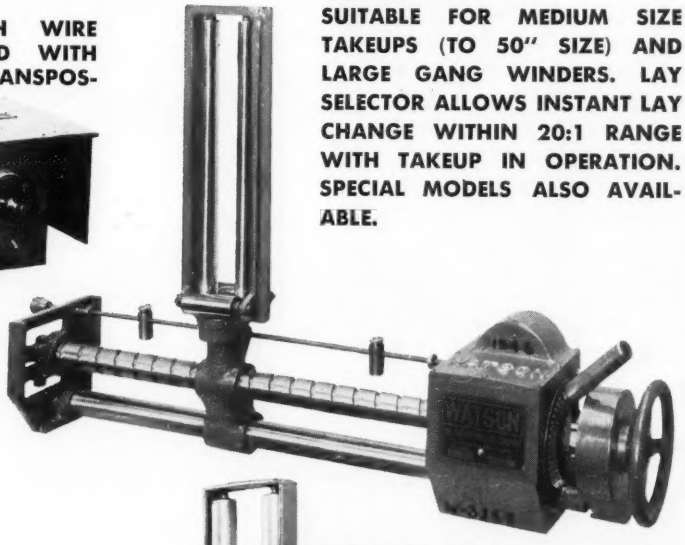
TRAVERSE "E"

CAPABLE OF FUNCTIONING AT HIGH WIRE TENSIONS AND COMMONLY FURNISHED WITH SMALL STRANDERS AND WINDERS. TRANSPOSABLE CHANGE GEARS PROVIDE FOR LAY VARIATION SETTING.



TRAVERSE "C"

SUITABLE FOR MEDIUM SIZE TAKEUPS (TO 50" SIZE) AND LARGE GANG WINDERS. LAY SELECTOR ALLOWS INSTANT LAY CHANGE WITHIN 20:1 RANGE WITH TAKEUP IN OPERATION. SPECIAL MODELS ALSO AVAILABLE.



TRAVERSE "R"

A HEAVY DUTY, LOW COST UNIT FOR LARGE TAKEUPS. 20:1 RANGE, ADJUSTABLE IN OPERATION. DESIGN ALLOWS CHAIN, GEAR OR ROCKING MOTION DRIVE. ADAPTABLE TO MANUAL OPERATION AT WILL.

TRAVERSE "W"

MOST VERSATILE HEAVY DUTY UNIT EVER DESIGNED. INFINITE VARIATION WITHIN 20:1 RANGE, INSTANT SHIFT FROM AUTOMATIC TO HAND CONTROL AND VICE VERSA. ADAPTED FOR REMOTE CONTROL. SPECIAL EXTRA HEAVY DUTY MODEL "WW" AVAILABLE.

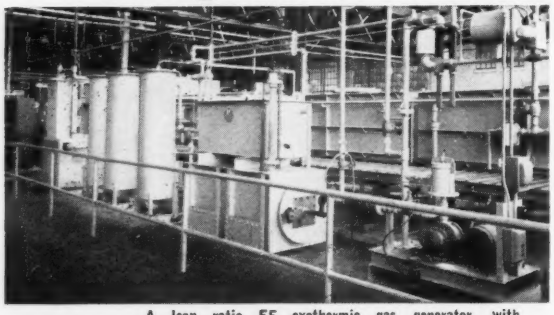
ALL MODELS AND TYPES PROVIDED WITH RAPIDLY ADJUSTABLE END POINT SETTING STOPS. INTERCHANGEABLE ROLLER OR SHEAVE GUIDE PROVIDED TO SUIT REQUIREMENTS.

* * * *

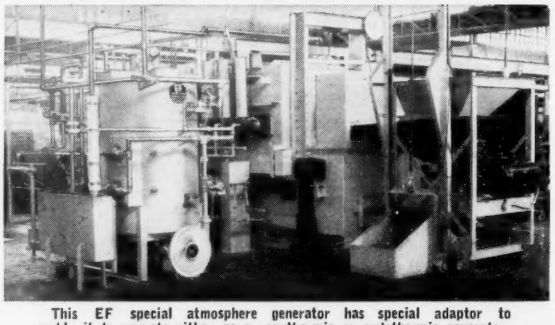
Bulletins Covering Each Model Available

4-56

designed for efficient, low cost operation

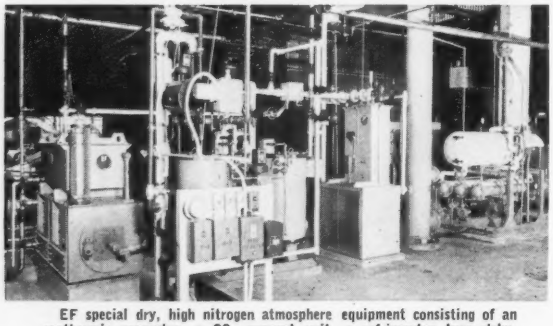


A lean ratio EF exothermic gas generator, with desulphurizers and refrigerator, produces the special atmospheres for the EF continuous bright annealing furnace shown in background. This is one of several EF units in a large copper and brass wire mill.

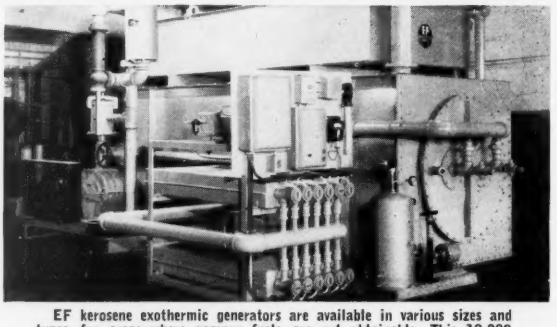


This EF special atmosphere generator has special adaptor to enable it to operate either as an exothermic or endothermic generator. It is used in connection with the continuous EF bolt hardening furnace at right, for scale free hardening or for carbon restoration.

SPECIAL ATMOSPHERE EQUIPMENT

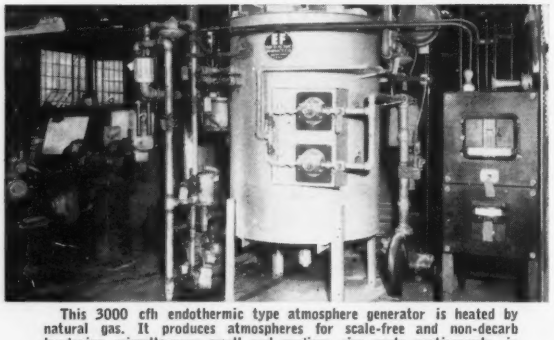


EF special dry, high nitrogen atmosphere equipment consisting of an exothermic generator, a CO_2 removal unit, a refrigerator type dehydrator, and a dryer for producing a dry, high nitrogen gas with low H_2 content suitable for bright annealing miscellaneous steel and non-ferrous products in various forms.

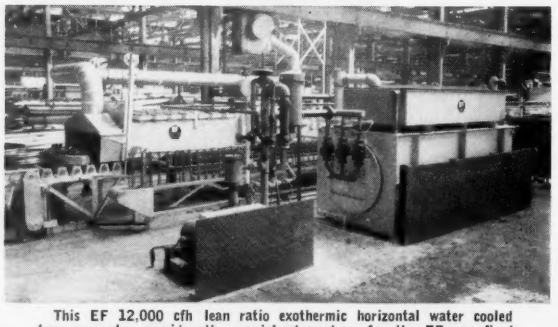


EF kerosene exothermic generators are available in various sizes and types for areas where gaseous fuels are not obtainable. This 12,000 cfh kerosene unit is shown undergoing our regular factory tests, prior to shipment to South America for use with EF furnaces for bright annealing copper and scale-free annealing brass.

produces the exact results required



This 3000 cfh endothermic type atmosphere generator is heated by natural gas. It produces atmospheres for scale-free and non-decarb hardening miscellaneous small and medium size parts continuously, in an EF gas fired radiant tube chain belt conveyor furnace.



This EF 12,000 cfh lean ratio exothermic horizontal water cooled type generator provides the special atmosphere for the EF gas fired continuous furnace shown in the background. This installation is used for bright annealing copper tubing both in coils and straight lengths.

for any heat treating process—any capacity

Years of practical experience in designing and building special atmosphere furnaces and generators enable EF engineers to furnish rugged, efficient, heat processing equipment with a reputation for successful, low cost operation and maintenance.

For endothermic and exothermic gas generators, ammonia dissociators, refrigerators, dryers, desulphurizers, gas scrubbing units, CO_2 removal units, or any other special atmosphere equipment, or furnaces, consult our experienced engineers—it pays.

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